

**RECORDS
OF THE
ZOOLOGICAL SURVEY OF INDIA**

Volume 109 (Part-3)

Year 2009



Zoological Survey of India



सत्यमेव जयते

**INVITATION OF NOMINATIONS FOR THE NATIONAL FELLOWSHIP
AWARDS FOR PITAMBER PANT NATIONAL ENVIRONMENT
FELLOWSHIP AND DR. B.P. PAL NATIONAL ENVIRONMENT
FELLOWSHIP AWARD FOR BIODIVERSITY FOR THE YEAR 2009**

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- (ii) Dr. B.P. Pal National Environment Fellowship Awards for Biodiversity for the year 2009.

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Records of the Zoological Survey of India

Volume 109(Part-3)

Edited by the Director, Zoological Survey of India, Kolkata



सत्यमेव जयते

**Zoological Survey of India
Kolkata
2009**

CITATION

Editor—Director. 2009. *Rec. zool. Surv. India*, **109**(Part-3) : i-viii, 1-116 (Published by the Director, *Zool. Surv. India*, Kolkata)

Published – October, 2009 (July-September Issue)

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PRICE

India : Rs. 250.00

Foreign : \$ 0.00; £ 0.00

Published at the Publication Division by the Director, Zoological Survey of India, 234/4, A J C Bose Road, 2nd MSO Building, (13th Floor), Nizam Palace, Kolkata-700 020 and printed at East India Photo Composing Centre, Kolkata-700 006.

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Dr. RAMAKRISHNA
Director
Zoological Survey of India

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In order to enrich the “*National Zoological Collection*” (NZC) and to up date information on the occurrence and distribution of animal species in India Scientists/Naturalists and researchers working on animal taxonomy/systematics are requested to deposit their identified specimens to the Zoological Survey of India at the following address :

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Director
Zoological Survey of India

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Silas, E.G. 1961. Occurrence of the Sea-cow *Halicore dugong* (Erxl) off Saurashtra coast. *J. Bombay nat. Hist. Soc.*, **58**(1) : 263-266.

State Fauna/Conservation Areas

Mukhopadhyay, S.K. 1999. Fresh water Oligochaetes. *Fauna of West Bengal, State Fauna Series*, **3**(Part-10) : 95-123. Published by Zool. Surv. India.

Radhakrishna, C. 2007. Amphibia. In : *Fauna of Kudermukh National Park, Karnataka, Conservation Area Series*, **32** : 20-25, Published by Zool. Surv. India.

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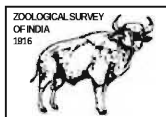
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Rec. zool. Surv. India, **109**(Part-3) : 1-4, 2009



CHARLES DARWIN : A BIOGEOGRAPHER PAR EXCELLENCE AND A FIGUREHEAD OF RATIONAL SCIENCE

2009 marks the bicentenary of the birth of Charles Darwin and, as well, November of this year, the 150th anniversary of the publication of his famous book, “*The Origin of Species*”. Darwin’s theory, the idea of evolution by natural selection, embodied in the book was a revolutionary departure from the deep-rooted, conservative line of thoughts on origin of life, with profound scientific and philosophical implications. Darwin’s theory of evolution by natural selection impregnated its ethos and impact throughout biology. It is now widely commented as ‘the best idea anyone ever had’, and acclaimed world over as the most influential change in human thought in modern times.

Charles Darwin was born on February 12, 1809 into a wealthy family in Shrewsbury Town in England. Since his boyhood days, love for nature was in his blood. The marvelous diversity of life in nature amazed him; collecting beetles, birds’ eggs and sea-shells was his fond hobby. As a

student, Darwin disliked the formal schooling, its stifling curriculum, and his frustration persisted until his university training. He tried, and dropped out, a medical education in Edinburgh. He joined the Anglican clergy at Cambridge and though he graduated in it, he was a misfit in that field too.

Darwin's innate drive to delve deep into the intricacies of the natural world and his zeal in geology inspired him to travel. His reputation as a naturalist earned him a place on a round-the-world trip on HMS Beagle, the British frigate, which primed him for his revolutionary ideas on evolution. The voyage took nearly five years from 1831 to 1836. Darwin spent two-thirds of his time on land, largely in the South American wilderness of Brazil, Argentina, Chile and remote areas such as the Galapagos Islands. During his expedition of the un-chartered frontiers of the continents and islands, Darwin was virtually in wonderlands amazingly observing, noting and collecting innumerable fossils and specimens, many of them unfamiliar and never before seen. Darwin was a precise and patient observer; ample evidences of changes that the Earth, climate and species had undergone over the geological times were unfolding before him. Darwin filled numerous notebooks with detailed observations on geology, fossils, plants and animals. The puzzling distribution of plants and animals in South America and the Galapagos Islands stirred his intellectual mind to question how species originated.

Darwin could send and receive mail from almost anywhere in the world since England was a thriving colonial power at that time, with a network of ships that literally spanned the globe. Darwin shipped crates of strange fossils/specimens of plants and animals, including detailed descriptions and geological observations, to Prof. Henslow, his Cambridge mentor. Despite his far flung isolation from the scientific community, the voyage helped Darwin move into their elite circle. Darwin was one among them when he got back to England, not just as an accomplished observer and collector, but a scientific celebrity, as an established biogeographer and theorist.

The Beagle voyage was "by far the most important event" in Darwin's life. When he set sail, the 22-year-old Darwin was a young graduate, and a budding naturalist. By the time he returned, he was an established naturalist. The Beagle voyage provided Darwin a lifetime of experiences to ponder and metamorphose from a promising observer into a probing theorist.

By the end of his voyage, Darwin was looking at species in a different way, rather than considering them as unique marvels of nature. His intuition prompted him to become inquisitive on how species might be related to one another. Back in England, the relationship between old and new species, as shown in fossils, became one of the main lines of evidence leading to Darwin's theory of evolution.

Before Darwin, the view about the world was different—the world as being stable and unchanging entity. Most people hardly believed humans were part of the natural world; rather nurtured the view that people were created by God to rule over animals, "over the fish of the sea and over the birds of the sky"—the Biblical story of creation. There were bold thinkers, like, Jean-Baptiste

Lamarck, who speculated that species had evolved, and that all life shared a common ancestor. But none could convincingly explain how it worked.

Darwin saw the world in a new way. Darwin, shortly after his return from the Beagle-voyage expedition, started formulating his thoughts/ideas on evolution. For his ideas, like, the struggle for existence and natural selection, he drew inspiration from the work of Thomas Robert Malthus, the English economist and demographer, whose principle of population had advocated that human populations always eventually out-run the means to sustain them.

Darwin made voluminous scientific correspondences with eminent scholars and even the back yard of his house became a field laboratory to work out proofs of natural selection. However, Darwin's thoughts on his theory, which remained just in scribbled noting and pencil-sketches of 1842, besides an essay of 1844, got delayed in the form of a solid publication until the late 1850s. "*The Origin of Species*" was first published in November 1859 when he was spurred into action by the parallel ideas and work of Alfred Russel Wallace, which hurried Darwin into the synthesis of his work.

"*The Origin of Species*" generated far-ranging brain-storms in the scientific world. While Darwin's ideas of evolutionary change and common ancestry were widely accepted, his principal mechanism for change—that is, natural selection—was not, even for a few decades after his death. However, in the mid-20th century, Darwin's intellectual legacy was legitimized with the Mendelian genetics in the form of the 'Modern Synthesis', manifesting the impact and influence of Darwin's theory of evolution. Even Alfred Russel Wallace, who had independently coined the same idea of evolution, made his remark: "Mr. Darwin has given the world a new science."

Since 1859, Darwin and his ideas have risen and fallen in favor, especially around 1900 with the fervor over new genetics, and again in the 1950s with the rise of molecular biology. But, the relevance of natural selection time and again resurfaces to reestablish its importance. Darwin's funeral was in 1882. The universal legitimacy and recognition to the Darwin's theory has evoked the impression that as modern science raced forward with high-tech tools and techniques, there was still a place for Darwin's simple, conventional tools—a pencil and paper—keen and curious observation, and, above all, an inventive, analytical mind.

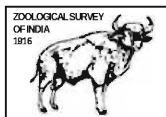
Today, man by his willful selection is capable of producing great results. He can adapt organic beings, plants/animals, to his own use to a great degree of success, subjecting them to accumulate slight but useful variations that are found in nature. But 'Natural Selection' is an omnipotent mechanism incessantly working in nature, which is immeasurably superior to man's feeble and fleeting efforts.

Prof. Janet Browne, the authoress of a two-volume biography of Darwin, has rightly observed that his theory is "the central organizing concept of modern biology—the idea that evolution occurs through natural selection and provides a logical explanation of the diversity of life." The "clarity

and impact” of “*the Origin of Species*” has the explanatory power that still resonates 150 years later. And, disseminating his transcendental aura to horizon, Prof. Janet Brown further remarks : “Darwin is a transformative figure whose system of thought has propelled scientific transformations in two centuries, and now a third.”

Yet, as a paradox, Darwin’s thoughts and theory are now facing a fresh wave of ire and fire from the neo-protagonists of creationism, even while the world is marching ahead on rational approaches and opinions predominantly imbibed from the wisdom and vision of modern science. Whatsoever, Darwin’s transformative idea of evolution through natural selection has been part of our culture for 150 years! The scientific community while commemorating his anniversary celebration is convinced of the view that Darwin’s ideas have had a universality that transcends time and place in understanding the scientific essence of origin of species and their evolution. Any society of people upholding the tenets of rational science needs to confirm a collective identity to Darwin’s scientific theory in order to reaffirm him his place as an eminent “figurehead of rational science” through his work “*The Origin of Species by Means of Natural Selection.*”

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Rec. zool. Surv. India : **109**(Part-3) : 5-9, 2009

A NEW SUBGENUS AND TWO NEW SPECIES OF THE FAMILY OPPIIDAE (ACARINA : ORIBATIDA) FROM INDIA

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INTRODUCTION

The members of the family Oppiidae are represented in India by 26 genera in which *Aeroppia* and *Striatoppia* are known by one and seven species respectively. The genus *Aeroppia* was first recorded from India by Sanyal (2000) from Tripura and of the seven species of *Striatoppia* four were reported from West Bengal (Chakraborti *et al.* 1973, Joy and Roy 1986, Sanyal 1992) and three others were known from Tripura of which two species were described as new to science (Subias and Sarkar 1983, Bhattacharya *et al.* 1985). The present work includes description of one new subgenus *Paraeroppia* and two new species *Aeroppia* (*Paraeroppia*) *indiana* and *Striatoppia* *asiaticus* from Tripura, India.

Keywords : Acarina, Oribatida, Oppiidae, *Paraeroppia*, subgen.n., *Aeroppia* (*Paraeroppia*) *indiana* sp.n., *Striatoppia* *asiaticus* sp.n., India.

MATERIAL AND METHODS

The specimens studied here were collected from litter and soil samples through the standard method of extraction with the Tullgren funnel extraction apparatus. All measurements are given in micrometers (μm).

SYSTAMATICS

Family OPPIIDAE GRANDJEAN, 1954

Genus *Aeroppia* Hammer, 1961

Subgenus *Paraeroppia* subgen.n.

Subgeneric diagnosis : Hysterosoma with 12 pairs of setae, 7 pairs of similar setae on dorsal surface, *lm* absent, 2 pairs of thick air filled setae on posterior border of notogaster.

Type-species : *Aeroppia* (*Paraeroppia*) *indiana* sp. n.

Aeroppia (*Paraeroppia*) *indiana* sp. nov.

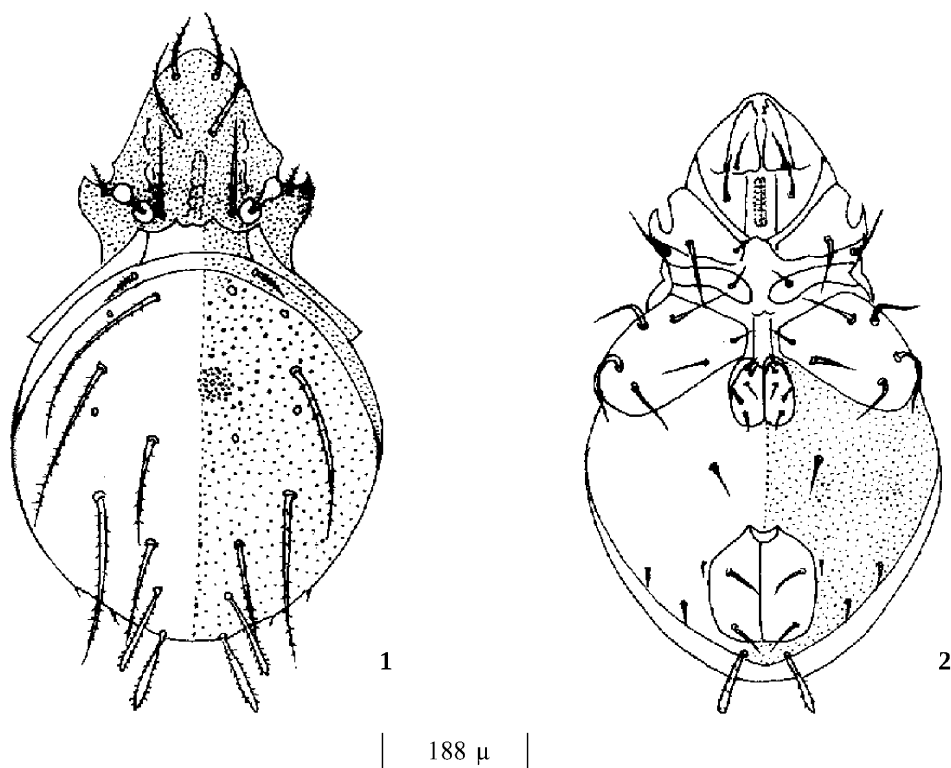
(Figs. 1-2)

Colour : Chestnut brown.

Measurements : Female (holotype) : Body 652 long, 399 wide (649 and 658 long and 392 and 413 wide in 2 paratypes).

Prodorsum (Fig. 1) : Rostrum rounded; rostral setae long (70) nearly twice their mutual distance (44), bilaterally feathered, moderately thick base becoming thin gradually and ended in pointed tip; lamellar setae longest (112) of all prodorsal setae, thin, rough, more than twice their mutual distance (43), placed on very short apophyses; interlamellar setae long (104), erect, thick, beset with bristles, placed at posterior border of pseudostigmata, less than twice their mutual distance (74); sigilla for the cheliceral retractor muscles present in two rows of light spots, each with seven, between lamellar setae; trichobothria with short (26), thin stalk, head (diameter : 22) small, ball-shaped; exopseudostigmatic setae short (55) with bristles; on latero-posterior part of propodosoma, cuticle with many tubercles; middle part of propodosoma finely punctated; posterior part of prodorsum with three prominent semilunar crests.

Notogaster (Fig. 1) : On either side of dorsosejugal region, a tooth like projection runs backward as keel for a very short distance; notogaster with 12 pairs of setae, one pair of setae *ta* minute, placed lateral to keel; 7 pairs of long, thick, stiff setae, almost equally thick throughout, tips pointed,



Figs. 1-2. *Aeroppia (Paraeroppia) indiana* sp. n., Adult female : 1 - dorsum; 2 - venter.

with bristles, except dm (107) all longer than lamellar setae, r_2 (196), la (189), ti (174), da (129), posterior two pairs of setae p_1 (85) and r_1 (104) placed on short apophyses, air filled, stiff, with spines, two pairs of postero-lateral setae p_2 and p_3 very thin, short; notogaster densely punctated. Ventral plate with minute tubercles.

Epimeral region (Fig. 2) : Epimeres I and II well separated, III and IV fused; epimeral setae moderately long (38-74), thin, smooth with setal formula 3-1-3-3.

Ano-genital region (Fig. 2) : Genital plates rectangular (length : 67, width : 55) with 5 pairs of setae; anal plates separate from genital plates by 133 μ m; anal plates punctated and equal in length and width (107) with 2 pairs of setae, setae an_2 (41) longer than setae an_1 (30); fissure iad minute and close to anal plates; ad_1 long (78), thick, rough air filled setae behind anal plates, setae ad_2 and ad_3 short; ventral plates finely punctated.

Legs : Legs monodactylous. Leg chaetotaxy : I : 2-4-3-4 + 1-19-1; II : 2-4-3-4 + 15-1; III : 3-3-2-3 + 1-12-1; IV : 1-2-2-4-8-1.

Type material : Female holotype, 2 female paratypes, from decomposed soil with loose litter, India : Tripura, Pulcharri (Sabrum), 4. vii. 1993, coll. D. Saha.

Type depositories : Holotype and 2 paratypes are deposited in the National Zoological Collection, Zoological Survey of India, Kolkata, India.

Differential diagnosis : On the basis of subgeneric diagnosis, the new species is distinguishable from the species under the subgenus *Aeroppia* (*Aeroppia*).

Genus ***Striatoppia*** Balogh, 1958

Striatoppia asiaticus sp. nov.

(Figs. 3-4)

Colour : Brownish.

Measurements : Female (holotype) : Body 245 long, 121 wide (235-261 long and 117-125 wide in 11 paratypes).

Prodorsum (Fig. 3) : Rostrum rounded; rostral setae moderately long (14), placed at end of two prolamellae present in between rostrum and translamella; translamella developed; lamellar costulae not prominent; lamellar setae short (7), half to rostral setae, fan-shaped; interlamellar setae short (5), thin; two long but faint ridges adjacent to interlamellar setae which enclose 4 light areas of weak chitination; bothridium cup-shaped; sensillus fusiform with rows of papillae; prolamellar, lamellar and interlamellar regions well granulated.

Notogaster (Fig. 3) : Notogaster oval-shaped, smooth, striated; 10 pairs of moderately long (12-14) notogastral setae, all setae including p_1 fan-shaped with longitudinal striation.

Epimeral region (Fig. 4) : Epimere I broad, separated by a prominent sternal plate, epimeres II and fused III-IV separated by narrow ridge; apodemata II narrow, sejugal apodemata very broad; epimeres marginally reticulated with punctation, epimeral setal formula 3: 1: 3: 3; $1b$, $3b$, $4a$, $4b$ long, broad and barbed.

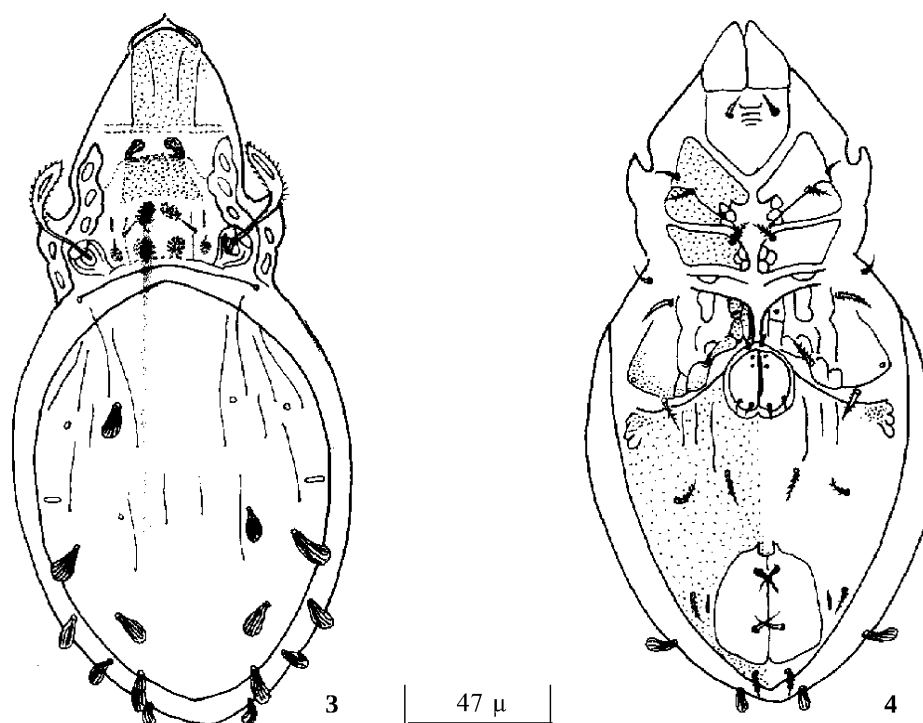
Ano-genital plates (Fig. 4) : Genital plates more or less squarish (length : 23, width : 21) with 5 pairs of smooth setae; aggenital and adanal setae finely barbed, anterior portion of ventral plates faintly striated, thickly punctated; anal plates almost rectangular in shape (length : 40, width : 35) with 2 pairs of setiform setae; *iad* fissures adjacent to anal plates.

Legs : Legs monodactylous, punctated. Leg chaetotaxy : Leg I : 3-2-0-4-16+1; Leg II : 3-0-0-3-7-1; Leg III : 0-2-1-4-10-1; Leg IV : 3-1-0-3-12-1.

Type material : Female holotype, 11 female paratypes, from soil with cowdung, India : Tripura, Dhuptali (Udaipur), 22. i.1992, coll. S. Saha.

Type depositories : Holotype and 11 paratypes are deposited in the National Zoological Collection, Zoological Survey of India, Kolkata, India.

Differential diagnosis : The new species approaches close to *Striatoppia similis* Subias and Sarkar, 1983 from Tripura, India regarding nature of rostral, lamellar, interlamellar and notogastral setae, nature of sensillus and nature of epimeral setae (except 4b). But it can be easily separated from Subias and Sarkar's species by the presence of fan shaped notogastral setae *p*, absence of granulation in notogaster, shape of prolamellar ridges and in having barbed aggenital and adanal setae.



Figs. 3-4. *Striatoppia asiaticus* sp.n., Adult female : 3 – dorsum; 4 – venter.

SUMMARY

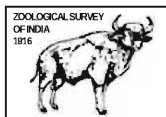
A new subgenus *Paraeroppia* and two new species of oribatid mite viz., *Aeroppia* (*Paraeroppia*) *indiana* and *Striatoppia asiaticus* collected from soil in Tripura, India are described and illustrated. The new subgenus and the species under it are erected on the presence of 12 pairs of hysterosomal setae and two pairs of thick air-filled setae on notogaster. *S. asiaticus* was distinguished by presence of fan-shaped setae *p*, absence of notogastral granulation, shape of prolamellar ridges and barbed aggenital and adanal setae.

ACKNOWLEDGEMENTS

The author is grateful to the Director, Zoological Survey of India, for providing necessary facilities.

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Rec. zool. Surv. India : **109**(Part-3) : 11-26, 2009

MANTID (INSECTA : MANTODEA) FAUNA OF OLD BIHAR (BIHAR AND JHARKHAND) WITH SOME NEW RECORDS FOR THE STATE

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INTRODUCTION

Mantids (Insecta : Mantodea) popularly called “praying mantids” play very important role in the terrestrial ecosystems helping to check the populations of noxious insect pests. They are predatory insects actively feeding on a variety of other insects like grass hoppers, moths, flies, aphids etc and are also well known for their camouflage and mimicry. Being an active group of predatory insects they also destroy non-injurious and beneficial insects. Despite rich fauna in India, our knowledge on the diversity and biological attributes of the mantids is far from satisfactory. It was Mukherjee *et al* (1995) who compiled all the available information on Indian mantids which included 162 species under 68 genera and six families. In recent years increased attention has been paid on the taxonomic studies on the mantid fauna of India, along with the description of some interesting new taxa from the country (Ghate and Ranade, 2002, Ghate and Mukherjee, 2004, Thulsi Rao *et al.*, 2005, Sureshan *et al.*, 2004 a,b, 2006 a,b,c, Vyjayandi & Narendran, 2003, 2005, Vyjayandi *et al.* 2006, Vyjayandi, 2007). The present work is an attempt of discovering the mantid fauna of Bihar and Jharkhand (Old Bihar) based on recent collections made from Bihar and Jharkhand and on the information available in the literature. The specimens were identified following Mukherjee *et al.*, 1995 and Ehrmann (2002) was followed for recent classification. According to Mukherjee *et al.* (1995), there are 16 species of mantids belonging to 12 genera under 6 families are reported from Bihar. The present paper altogether deals with 25 species of mantids belonging to 21 genera and 8 families known from Bihar and Jharkhand (old Bihar state). 13 species under 12 genera and 5 families are collected and studied in the present work out of which 9 species belonging to 9 genera are reported for the first time from the state. The material studied is deposited in the collections of Zoological Survey of India, Gangetic plains regional station, Patna, Bihar.

The following abbreviations are used in the text.

BL-Body length (in mm, measured from anterior margin of head to tip of abdomen); PN-Pronotum; FW-Forewing ; M-Male, F-Female.

SYSTEMATIC ACCOUNT

Order MANTODEA

Family AMORPHOSCELIDAE

Subfamily AMORPHOSCELINAE

1. *Amorphoscelis annulicornis* Stal

1871. *Amorphoscelis annulicornis* Stal, *Ofvers. K. Vetensk Akad. Forh*, **28** : 401.

1915. *Amorphoscelis indica* Giglio-Tos. *Bull. Soc. Entomol. Ital.*, **46** : 33.

1956. *Amorphoscelis keiseri* Beier. *Verh. Naturf. Ges. Basel*. **67** : 33.

Distribution : India : Assam, Bihar, Daman & Diu, Himachal Pradesh, Kerala, Meghalaya, Orissa, Maharashtra, Tamil Nadu, West Bengal; Sri Lanka.

Remarks : Common species occurring on tree trunks in all warmer parts of India. It displays darting movement of cerci. Reported from Bihar with no further data (Mukherjee *et al.*, 1995).

Family HYMENOPODIDAE

Subfamily ACROMANTINAE

Tribe ACROMANTINI

2. *Hestiasula brunneriana* Saussure**

(Photo. 1)

1871. *Hestiasula brunneriana* Saussure. *Mem. Soc. Phys. Hist. Nat. Geneva*, **21** : 330.

1927. *Hestiasula brunneriana* Giglio-Tos. *Das Tierreich*, **50** : 545.

Material examined : 1 nymph (Male), Bihar, Patna district, Fathua, 9.i.2008; 1 nymph (male), Vaishali district, Gatarotola, 31.i.2009, coll.P.M.Sureshan.

Distribution : India : Andhra Pradesh, Kerala, Meghalaya, Orissa, Maharashtra, W. Bengal, Bihar; Bangladesh and Sri Lanka.

Remarks : The species is reported for the first time from Bihar.

3. *Ephestiasula pictipes* (Wood-Mason)**

1879. *Hestias pictipes* Wood-Mason. *Proc. Asiatic. Soc. Bengal*. 258.

1904. *Hestiasula pictipes* : Kirby. *Cat. Orth. Brit. Mus.* **1** : 288.

1914. *Ephestiasula pictipes* : Giglio-Tos. *Bull. Soc. Entomol. Ital.* **46** : 101.

Material examined : 1 nymph (Female), Bihar, Patna district, Saguni, 6.ii.2008, coll. P.M. Sureshan.

Distribution : India : Madhya Pradesh, Orissa, Maharashtra, Uttar Pradesh, Bihar.

Remarks : The species is reported for the first time from Bihar.

4. *Euantissa pulchra* (Fabricius)**

1787. *Mantis pulchra* Fabricius. *Mant. Ins.* **1** : 229.

1927. *Euantissa pulchra* : Giglio-Tos. *Das Tierreich*, **50** : 541.

Diagnostic characters : Body green. Forewing dark green, opaque, costal area yellow, rest green; hind wings transparent, basal part pink, posterior border with brown band. Frontal sclerite transverse with two lateral grooves below widely arched superior border, lateral grooves of vertex extending beyond the margin of eyes; fore femora with four external spines, four discoidal spines and twelve internal spines, all spines are black at tip only.

Measurements : BL F, 17; PN 5, FW 11.

Material examined : 1F, 2 nymph (female), Bihar, Patna district, Fathua, Janardhanpur, 11.ii.2009; 8 nymphs, Fathua, 8.i.2008, coll. P.M. Sureshan; 1 nymph. Bihar, Patna city, 25.ii.1967, coll. S.P. Pal.

Distribution : India : Eastern, North eastern and southern parts.

Remarks : A common species. Reported for the first time from Bihar.

Subfamily HYMENOPODINAE

5. *Creobroter laevicollis* (Saussure)**

(Photo 3)

1870. *Creobotra laevicollis* Saussure, *Mitt. Schweiz. Entomol. Ges.*, **3** : 242.

1904. *Creobroter laevicollis* : Kirby, *Cat. Orth. Brit. Mus.*, **1** : 291.

1927. *Creobroter laevicollis* : Giglio-Tos, *Das Tierreich*, **50** : 557.

Diagnostic characters : Vertex with a spine. Prozona of pronotum denticulate, metazona almost smooth. Fore coxae in female with 6-8 spines, in male with 5-6 spines. Fore wing with a small yellow spot latero-basally; eye-spot is a little in front of middle and contains one black dot; anal membrane mostly blackish in male, hyaline in female. Hind wing pink at base and sometimes at costal area; smoky patch is in the centre of wing, round, prominent and does not spread out from centre, much less prominent in male.

Measurements : BL M 29, F 29-30; PN M 6, F 6.5-7; FW M 26, F 24.

Material examined : 1M, 1F, Bihar, Nalanda Dist, Rajgir, 27.ix.2007, coll. P.M. Sureshan; 1F, Jharkhand, Dalma wild life sanctuary, Pindrapera, 6.viii.2008, coll. S. Sampath (Under light).

Distribution : India : Andhra Pradesh, Assam, Meghalaya, Sikkim, West Bengal, Jharkhand, Bihar; Indonesia : Java.

Remarks : This is the first record of the species from Bihar and Jharkhand.

Family LITURGUSIDAE

Subfamily LITURGUSINAE

Tribe LITURGUSINI

6. *Humbertiella ceylonica* Saussure*

(Photo 5)

1869. *Humbertiella ceylonica* Saussure. *Mitt. Schweiz. Entomol. Ges.* **3** : 62.

1891. *Theopompa sepentrionum* Wood-Mason. *A catalogue of the Mantodea* 2 : 64.

1927. *Humbertiella ceylonica* : Giglio-Tos. *Das Tierreich*. 50 : 64.

Diagnostic characters : Body deep brownish. Frontal sclerite black or blackish brown, superior margin less arched, usually brown in female and light brown or pale whitish in male; longer internal spines of fore femur black; forewing in male longer than body, reaching up to 5-6 abdominal segments in female.

Measurements : BL : M 31-32; PN : 6-7; FW 29.

Material examined : 2M, Jharkhand, Dalma Wild life sanctuary, Pindrapera, 6.viii.2008, coll. S. Sampath (under light).

Distribution : India : Orissa, Kerala, Karnataka, Jharkhand, Tamil Nadu, Assam, Uttar Pradesh, West Bengal, Madhya Pradesh, Maharashtra.

Remarks : The species has been already reported from Hazaribagh, Jharkhand (Mukerjee *et al.*, 1995).

Family MANTIDAE

Subfamily OXYOTHESPINAE

7. *Heterochaetula tricolor* (Wood-Mason)

1876. *Heterochaetula tricolor* Wood-Mason, *Ann. Nat. Hist.*, 18(4) : 441.

1927. *Heterochaetula tricolor* : Giglio-Tos, *Das Tierreich*, 50 : 287.

Distribution : India : Jharkhand, Maharashtra, Orissa, West Bengal.

Remarks : Reported from Singbhum : Chandil (Jharkhand) based on one female specimen (Mukherjee *et al.*, 1995).

Subfamily SCHIZOCEPHALINAE

8. *Schizocephala bicornis* (Linnaeus)**

(Photo 8)

1758. *Gryllus (Mantis) bicornis* Linnaeus. *Syst. Nat.* 1(10) : 426.

1767. *Mantis bicornis* Linnaeus. *Syst. Nat.* 2(12) : 691.

1781. *Mantis oculata* Fabricius. *Spec. Ins.* 1 : 348.

1792. *Mantis stricta* Olivier. *Ann. Sci. Nat.* 22 : 56.

1927. *Schizocephala bicornis* Giglio-Tos. *Das Tierreich*, 50 : 237.

Material examined : 1 male nymph, Bihar, Vaishali district, Gatarotola, 31.i.2009, coll. P.M. Sureshan.

Distribution : India : Madhya Pradesh, Maharashtra, Uttar Pradesh, Kerala, West Bengal, Orissa, Bihar.

Remarks : The specimen collected from tall wild grass. Species reported for the first time from Bihar.

Subfamily AMELINAE

Tribe AMELINI

9. *Amantis fuliginosa* (Werner)**

(Photo 2)

1931. *Cimantis fuliginosa* Werner. *Proc. Zool. Soc. London*, 1330.2002. *Amantis fuliginosa* (Werner) in Ehrmann, *Mantodea : Gott. der Welt. Nat. Tier-Veriag Gomb* : 56.

Diagnostic characters : Frontal sclerite carinate with arched upper margin. Pronotum short, metazona dorsally with median furrow, wings extending beyond abdominal tip; costal area of forewing with sinuous transverse veins, discoidal area widely meshed with distinct false veins, radial vein forked at base, all veins blackish, hind wings fuliginous (greyish).

Measurements : BL M 15; PN 3, FW 15.

Material examined : 1M, Jharkand, Dalma Wild life sanctuary, Pindrapera, 20.viii.2007, coll. S. Sampath (under light).

Distribution : India : Tamil Nadu, Jharkand, Kerala.

Remarks : High altitude species. Reported for the first time from Jharkand and North India.

Subfamily PARAMANTINAE

Tribe PARAMANTINI

10. *Hierodula tenuidentata* Saussure*

(Photo 9)

1869. *Hierodula tenuidentata* Saussure. *Mitt. Schweiz. Entomol. Ges.* **3** : 68.1927. *Hierodula (Hierodula) tenuidentata* : Giglio-Tos. *Das Tierreich.* **50** : 444.

Diagnostic characters : Frontal sclerite a little wider than high; pronotum narrower after dilation and then almost parallel except near base. Prosternum with two blackish transverse bands in posterior part. Fore coxae with 5 short spines and few spinules among them, both wings longer than body, costal area greenish, discoidal area hyaline.

Measurements : BL : F, 59-72; PN 17-23, FW : 40-57.

Material examined : 1F, Jharkhand, Dalma wildlife sanctuary, Macalakocha, 12.xii.2008, coll. S. Sampath (under light); 1F, 1 nymph (male) Bihar, Muzafarpur, Bhagwanpur, 2.xii..2007, coll. P.M. Sureshan; 1F, Bihar, Patna, Jogipur, 25.ix.1970; coll. R.K. Varshney; 1F, Bihar, no other data; 1F, Bihar, Patna, Surajpur, 4.vii.1976, coll. Bindu.

Distribution : India : Andamans, Bihar, Jharkhand, Lakshadeep, Madhya Pradesh, Kerala, Orissa, Maharashtra.

Remarks : The blackish band of prosternum fades in old preserved specimens. Species already reported from Madhupur, Jharkhand (Mukherjee *et al.*, 1995).

11. *Hierodula bipapilla* (Audinet-Serville)

1839. *Mantis bipapilla* Audinet-Serville. *Hist. Nat. Ins. Orth.* 188.
 1889. *Hierodula patellifera* Westwood. *Revis. Mantid.* p. 35.
 1904. *Hierodula bipapilla* Kirby. *Cat. Orth. Brit. Mus.* **1** : 245.
 1927. *Hierodula (Hierodula) bipapilla* : Giglio-Tos. *Das Tierreich.* **50** : 448.

Distribution : India : Jharkhand, Himachal Pradesh, Uttar Pradesh, West Bengal; Indonesia, Java, China, Taiwan, Japan.

Remarks : Reported from Dhanbad (Jharkhand) based on one male specimen (Mukherjee *et al.*, 1995).

12. *Hierodula doveri* Chopard**

1924. *Hierodula doveri* Chopard, *Rec. Indian Mus.* **26** : 175.

Diagnostic characters : Frontal sclerite pentagonal, bicarinate, almost as wide as high, upper margin widely angular. Pronotum slender with oval supra coxal dilation, metasoma of prosternum with two pairs of brownish dots and median strip of same colour. Fore coxae armed with 6 tubercular premarginal spines, femora with seven long and seven short spines, shorter spines are black at tip. Forewing with costal area yellow-green and densely reticulate.

Measurements : BL; M 59-64; PN : 21-23; FW : 42-46.

Material examined : 3M, Jharkhand, Dalma wild life sanctuary, Pendrapera, 20.viii.07, coll. S. Sampath (under light).

Distribution : India : Jharkhand, Karnataka, W. Bengal, Kerala, Orissa, Tamil Nadu.

Remarks : Reported for the first time from Jharkhand.

13. *Rhombodera doriana* Laidlaw

1931. *Rhombodera doriana* Laidlaw. *Entomol. Monthly Mag.* 88-90.

Distribution : India : Jharkhand.

Remarks : Known only from the holotype from Ranchi, Jharkhand (Mukerjee *et al.*, 1995).

14. *Rhombodera tectiformis* Saussure

1870. *Hierodula tectiformis* Saussure. *Mitt. Schweiz. Entomol. Ges.* **3** : 232.
 1927. *Hierodula (Rhombodera) tectiformis* : Giglio-Tos. *Das Tierreich*, **50** : 453.

Distribution : India : Jharkhand, Sikkim, Tamil Nadu, West Bengal.

Remarks : Reported from Madhupur, Jharkhand based on 1 male specimen (Mukherjee *et al.*, 1995).

Tribe MANTINI

15. *Mantis religiosa inornata* Werner**

(Photo 4)

1930. *Mantis inornata* Werner. *Proc. Zool. Soc. London*, 1930 : 689.

2002. *Mantis religiosa inornata* Werner in : Ehrmann, Mantodea, 216.

Diagnostic characters : Body green. Fore wings green, anterior half of costal area reddish brown and hyaline in discoidal area. Hind wings hyaline. Frontal sclerite with distinct median groove, superior margin arched. Pronotum long, metazona carinate, with two whitish spots ventrally. In fore legs coxal borders with 6-7 minute spines and few spinules, no callous spots, internal apical lobes divergent; claw groove of femora with yellow patch. Fore femora have 4 discoidal spines, 4 external spines and 15 internal spines, black at tips.

Measurements : BL; F 67; PN, 23, FW 55.

Material examined : 1F, Bihar, Patna, Rajendra Nagar, 10.x.1996, coll. Bolanath.

Distribution : India : Kerala, Maharashtra, Orissa, Bihar, Uttar Pradesh.

Remarks : This the first record of the species from Bihar.

16. *Statilia apicalis* (Saussure)

1871. *Mantis apicalis* Saussure, *Mem. Soc. Geneve*, **21** : 291.

1877. *Statilia apicalis* : Stal, *Bih. K. Svenska Vetensk Akad. Handl.* **4**(10) : 55.

1904 *Pseudomantis apicalis*: Kirby, *Cat. Orth. Brit. Mus.*, **1** : 235.

1927. *Statilia apicalis* : Giglio-Tos. *Das Tierreich*, **50** : 411.

Distribution : India : Andhra Pradesh, Arunachal Pradesh, Bihar, Himachal Pradesh, Uttar Pradesh, West Bengal; Australia.

Remarks : Reported from Bihar with no further data (*Mukherjee et al.*, 1995).

17. *Statilia maculata* (Thunberg)

1784. *Mantis maculata* (Thunberg). *Nov. Ins. Spec.*, **3** : 61.

1897. *Statilia maculata* : Bolivar. *Ann. Soc. Entomol. France*, **66** : 309.

1927. *Statilia maculata* Giglio-Tos. *Das Tierreich*, **50** : 410.

Distribution : India : Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Himachal Pradesh, Kerala, Madhya Pradesh, Orissa, Maharashtra, Uttar Pradesh, Sikkim, West Bengal; Eastern Asia.

Remarks : The species is reported from Bihar with no further details (*Mukherjee, et al.*, 1995).

Subfamily MANTINAE

Tribe POLYSPILOTINI

18. *Tenodera superstitiosa* (Fabricius)

1781. *Mantis superstitiosa* Fabricius, *Spec. Ins.*, **1** : 348.

1871. *Tenodera superstitiosa* : Stal, *Ofvers k. Vetensk Akad. Forh.*, **28** : 390.

1927. *Tenodera superstitiosa* : Giglio-Tos. *Das Tierreich*, **50** : 415.

Distribution : India : Andamans, Bihar, Punjab, Uttar Pradesh; Africa.

Remarks : Reported from Bihar with no further details (*Mukherjee et al.*, 1995).

Subfamily MIOMANTINAE

Tribe RIVETININI

19. *Deiphobe infuscata* (Saussure)

1871. *Phasmomantis infuscata* Saussure, *Mem. Soc. Phy. Hist. Nat. Geneve*, **21** : 130.

1927. *Deiphobe infuscata* : Giglio-Tos, *Das Tierreich*, **50** : 488.

2006. *Deiphobe infuscata* : Vyjayandi. *J. Ent. Res.* **30**(4) : 339-361.

Distribution : India : Bihar, Himachal Pradesh, Kerala, Jammu & Kashmir, Madhya Pradesh, Tamil Nadu, Uttar Pradesh. Andhra Pradesh, Jharkhand.

Remarks : Reported from Madhupur, Palamu, Kijrum and Mundu in Jharkhand (Mukherjee *et al.*, 1995).

Family TOXODERIDE

Subfamily TOXODERINAE

Tribe TOXODEROPSINI

20. *Toxoderopsis taurus* Wood-Mason*

(Photo 7)

1889. *Toxoderopsis taurus* Wood-Mason., *J. Asiatic Soc. Bengal*, **58** : 320.

1927. *Toxoderopsis taurus* : Giglio-Tos, *Das Tierreich*, **50** : 569.

Measurements : BL M 97; PN 22, FW 44.

Material examined : 1F, Jharkhand, Hazaribagh National Park, 27.ix.1975, coll. R. K. Varshney.

Distribution : India : Jharkhand, Maharashtra, Orissa; Pakistan.

Remarks : Reported from Chotanagpur, Dhanbad (Jharkhand) (Mukherjee *et al.*, 1995).

Family TARACHODIDAE

Subfamily TARACHODINAE

21. *Didymocorypha lanceolata* Fabricius

1798. *Mantis lanceolata* Fabricius, *Syst. Entomol. Suppl.*, p. 191.

1877. *Schizocephala (Didymocorypha) ensifera* Wood-Mason, *Ann. Mag. Nat. Hist.*, (4)19 : 222.

1877. *Pyrgocotis gracilipes* Stal., *Bih. K. Svenska VetenskAkad. Handl.*, **4**(10) : 17.

1882. *Didymocorypha ensifera* : Wood-Mason., *J. Asiatic. Soc. Bengal*, **51** : 24.

1889. *Pyrgocotis ensifera* : Wood-Mason, *Revisio... Mantidarum.* p. 3.

1889. *Pyrgocotis gracilipes*: Westwood, *Revisio... Mantidarum.* p. 3.

1897. *Didymocorypha lanceolata*: Bolivar, *Ann. Soc. Entomol. France*, **66** : 303.

Distribution : India : Jharkhand, Karnataka, Madhya Pradesh, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal; Sri Lanka.

Remarks : One female (nymph) specimen reported from Rajmahal Hills, Jharkhand (Mukherjee *et al.*, 1995).

Family IRIDOPTERYGIDAE
 Subfamily TROPIDOMANTINAE
 Tribe TROPIDOMANTINI

22. ***Tropidomantis guttatipennis*** Stål*

1877. *Tropidomantis guttatipennis* Stal, Bih. K. Svenska Vetensk Akad Handl., 4(10) : 51.

1915. *Eomantis guttatipennis* : Giglio-Tos, Bull. Soc. Entomol. Ital., 46 : 47.

Diagnostic characters : A pair of minute elongate tubercles present between frontal sclerite and median ocellus of male. In female, whitish patches on frontal sclerite and ocelli visible. Fore femur with a shallow pit bordered by 3rd discoidal and proximal 2 external spines. Female with 9-10 external spines on fore tibiae, of which proximal two minute. Fore wing in female sub-opaque, with pale whitish central opaque spots in a few cells in basal half; in male, entire forewing almost hyaline.

Material examined : 1M, Jharkhand, Dalma wild life sanctuary, Pindrapera, 29.ix.2009, coll. S. Sampath (under light).

Measurements : BL M 24.0, PN 5, FW 18.

Distribution : India : Assam, Maharashtra, Bihar, Jharkhand, Gujarat, Karnataka, Tamil Nadu, West Bengal; Tibet.

Remarks : Mukerjee *et al.*, 1995 mentioned the distribution of the species in Bihar without any details.

Subfamily NANOMANTINAE
 Tribe NANOMANTINI

23. ***Parananomantis brevis*** Mukherjee**

(Photo 6)

1995. *Parananomantis brevis* Mukherjee. *Oriental Insects* : 29. 260.

Diagnostic characters : Body delicate, brownish yellow. Vertex with upper margin almost straight, lateral lobes prominent and separated by grooves; frontal sclerite transverse, superior margin arched and laterally sinuate.; pronotum with supra coxal dilation moderate, metazona almost as long as fore coxa with very fine linear carina, not raised; fore femur with straight upper margin, 4 external spines . proximal two of them little closer to each other, discoidal spines 3, tibia with 7 external spines with considerable gap between proximal two, second spine (from base) much longer than first, hind metatarsus little longer than other segments combined. ; supra anal plate broad, triangular and rounded at end and briefly carinate near at base.

Measurements : BL M 24-25 F 26-27; PN M 6-7, F 7; FW M 16, F 17-18.

Material examined : 2M, 2F, Jharkhand, Dalma wild life sanctuary, Pindrapera, 29.ix.2009, coll. S. Sampath (under light).

Distribution : India : Assam, Himachal Pradesh, Karnataka, Jammu, Manipur, West Bengal, Jharkhand.

Remarks : The species is reported for the first time from Jharkhand with first record of the female.

Family EMPUSIDAE

Subfamily EMPUSINAE

Tribe EMPUSINI

24. *Empusa fasciata* Brulle

1832. *Empusa fasciata* Brulle, *Exp. Moree*, 31 (Sec. 2) : 83.

1927. *Empusa fasciata* : Giglio-Tos, *Das Tierreich*, **50** : 637.

Distribution : India : Bihar; Philippines.

Remarks : Reported from Bihar with no further data (Mukherjee *et al.*, 1995).

25. *Gongylus trachelophyllus* Burmeister

1838. *Empusa (Gongylus) trachelophylla* Burmeister, *Handb. Entomol.*, **2** : 54.

1871. *Gongylus trachelophyllus* : Saussure, *Mem. Soc. Geneve*, **21** : 186.

1927. *Gongylus trachelophyllus* : Giglio-Tos, *Das Tierreich*, **50** : 635.

Distribution : India : Jharkhand, Orissa.

Remarks : Reported from Chotanagpur (Jharkhand) (Mukherjee *et al.*, 1995).

Systematic list of Mantodea of Bihar and Jharkhand (Old Bihar)

(Classification followed Ehrmann, 2002)

*collected and studied **First record from the state

Class INSECTA

Order MANTODEA

Family AMORPHOSCELIDAE

Subfamily AMORPHOSCELINAE

1. *Amorphoscelis annulicornis* Stal. (Bihar)

Family HYMENOPODIDAE

Subfamily ACROMANTINAE

Tribe ACROMANTINI

2. *Hestiasula brunneriana* Saussure (Bihar)**

3. *Ephestiasula pictipes* (Wood-Mason) (Bihar)**

4. *Euantissa pulchra* (Fabricius) (Bihar)**

Subfamily HYMENOPODINAE

5. *Creobroter laevicollis* (Saussure) (Bihar & Jharkhand)**

- Family LITURGUSIDAE
Subfamily LITURGUSINAE
6. *Humbertiella ceylonica* Saussure* (Jharkhand)
Family MANTIDAE
Subfamily OXYOTHESPHINAE
7. *Heterochaetula tricolor* (Wood–Mason) (Jharkhand)
Subfamily SCHIZOCEPHALINAE
8. *Schizocephala bicornis* (Linnaeus)** (Bihar)
Subfamily AMELINAE
Tribe AMELINI
9. *Amantis fuliginosa* (Werner)** (Jharkhand)
Subfamily PARAMANTINAE
Tribe PARAMANTINI
10. *Hierodula tenuidentata* Saussure* (Bihar & Jharkhand)
11. *Hierodula bipapilla* (Audinet-Serville) (Jharkhand)
12. *Hierodula doveri* Chopard** (Jharkhand)
13. *Rhombodera doriana* Laidlaw (Jharkhand)
14. *Rhombodera tectiformis* Saussure (Jharkhand)
Tribe MANTINI
15. *Mantis religiosa inornata* Werner** (Bihar)
16. *Statilia apicalis* (Saussure) (Bihar)
17. *Statilia maculata* (Thunberg) (Bihar)
Subfamily MANTINAE
Tribe POLYSPILOTINI
18. *Tenodera superstitiosa* (Fabricius) (Bihar)
Subfamily MIOMANTINAE
Tribe RIVETININI
19. *Deiphobe infuscata* (Saussure) (Jharkhand)
Family TOXODERIDAE
Subfamily TOXODERINAE
Tribe TOXODEROPSINI
20. *Toxoderopsis taurus* Wood-Mason* (Jharkhand)

Family TARACHODIDAE

Subfamily TARACHODINAE

21. *Didymocorypha lanceolata* Fabricius (Jharkhand)

Family IRIDOPTERYGIDAE

Subfamily TROPIDOMANTINAE

Tribe TROPIDOMANTINI

22. *Tropidomantis guttatipennis* (Stal)* (Jharkhand)

Subfamily NANOMANTINAE

Tribe NANOMANTINI

23. *Parananomantis brevis* Mukherjee** (Jharkhand)

Family EMPUSIDAE

Subfamily EMPUSINAE

Tribe EMPUSINI

24. *Empusa fasciata* Brulle (Bihar)

25. *Gongylus trachelophyllus* Burmeister (Jharkhand)

SUMMARY

The order Mantodea of old Bihar state (present Bihar and Jharkhand) is represented by 25 species belonging to 21 genera, 16 subfamilies and 8 families. Among these the family Mantidae has maximum representation (9 genera 13 species), followed by Hymenopodidae (4 genera, 4 species), Empusidae (2 genera, 2 species), Iridopterygidae (2 genera, 2 species), Amorphoscelidae (1 genus, 1 species), Liturgusidae (1 genus, 1 species), Toxoderidae (1 genus, 1 species), and Tarachodidae (1 genus 1 species). Most of the species are reported from the new Jharkhand state (13 nos.), and Bihar (5 species), both Bihar and Jharkhand (2 species) and 5 species are reported from Bihar with no further details of the locality. The species *Rhombodera doriana* Laidlaw is known only from Jharkhand (Ranchi). The species *Empusa fasciata* Brulle, and *Gongylus trachelophyllus* Burmeister are very rare and known only from Bihar, Jharkhand and Orissa. The occurrence of *Amantis fuliginosa* (Werner) in the forests of Dalma wild life sanctuary, Jharkhand is interesting. This is a high altitude species earlier reported only from the forested tracts of Tamil Nadu and Kerala. The study proved that the mantid fauna of the states of Bihar and Jharkhand is very poorly studied. Since most parts of Bihar and Jharkhand are practically unexplored for the mantid fauna, serious attempts for faunistic surveys and field collection of these insects will be highly rewarding.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. Ramakrishna, Director, Zoological Survey of India, Kolkata for providing facilities and encouragement. We are also grateful Dr. H.V. Ghate, Professor, Modern College, Pune, for critically going through the manuscript and useful suggestions.

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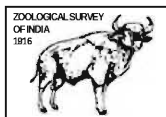
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Photos 1-5: 1. *Hestiasula brunneriana* Saussure, male nymph; 2. *Amantis fuliginosa* (Werner), male; 3. *Creobroter laevicollis* (Saussure), male; 4. *Mantis religiosa inornata* Werner, female 5. *Humbertiella ceylonica* Saussure, male



Photos 6-9: 6. *Parananomantis brevis* Mukherjee, female; 7. *Toxoderopsis taurus* Wood-Mason, female, 8. *Schizocephala bicornis* (Linnaeus), male nymph; 9. *Hierodula tenuidentata* Saussure, female.



Rec. zool. Surv. India : **109**(Part-3) : 27-31, 2009

HAEMADIPSA ANAIGUNDIENSIS SP. NOV. (HIRUDINEA : HAEMADIPSIDAE) A NEW SPECIES OF LEECH FROM TAMIL NADU, INDIA

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INTRODUCTION

There are more than 448 species of leeches in the world. In India only 63 leech species of leeches are recorded so far (Bandyopadhyay & Mandal, 2006). This new species has been collected from Nilgiri hills of Tamil Nadu during recent faunistic survey carried out by Zoological survey of India. In addition to this many new records have also recorded along with this. Harding and Moore (1924, 1927), Sanjeeva Raj and Gladstone (1981) have described number of new species from India. Mandal (2004) has described two new species from West Bengal. Soos (1965) is the pioneer in Taxonomy of leeches. Bandyopadhyay (2005), Mandal (1966, 2002, 2004 and 2005), Raut and Nandi (1980) have done some work on taxonomy and ecological work of leeches in West Bengal. Soota (1977), Chandra (1983), Blanchard (1917), Julka (1980) and Ghosh (1998) contributed a lot on the taxonomy of leeches.

MATERIALS AND METHODS

After making the collection, leeches were sorted out. Then the cleaned leeches were placed in a tray with a small quantity of water and were slowly killed by anaesthetizing with alcohol. Leeches usually die in an extended condition by the process. Just after death, the leeches were kept in 70% alcohol for permanent preservation. As fixing fluid 4% formalin may be used.

***Haemadipsa anaigundiensis* sp. nov.**

Holotype : Z.S.I. Reg. No. An 3259/1, 1 ex. Coll. A. Misra and party. 22.11.2004, Anaigundishola, District Poolachi, Tamil Nadu, India.

Paratype : Z.S.I. Reg. No. an 3260/1, 1 ex. Coll. A. Misra and party. 22.11.2004, Anaigundishola, District Poolachi, Tamil Nadu, India.

Diagnosis : *Colour* : Yellowish brown in living condition, fade up at preserved state.

Body : Small but robust, distinct head region, middle part of the body is more in breadth than the two ends. Posterior part is broader than the anterior part. It looks like the glossiphonid leech *Placobdella emydae*. Black patches on dorsal and ventral region.

Length : The total length of the body of *Haemadipsa anaigundiensis* is 7 mm-14 mm at rest.

Breadth : 4 mm.

Colour : Ash green in living, ash or brownish black in preservative.

Sucker : Anterior sucker .5 mm in diameter, posterior sucker 1 mm in diameter. Posterior sucker is almost round, anterior sucker looks like an earthen lamp. Jaws may be seen after preservation.

Eyes : Five pairs of eyes, fourth and fifth pair separated by two annuli.

Host and habitat : It is found in moist forest, sucks the blood of different animals and also human beings.

Distribution : India : Tamil Nadu (Anaigundishola forest, District Poolachi).

Remarks : The specific name is proposed according to the name of the place where from the first example was collected.

Table showing comparison of *Haemadipsa anaigundiensis* sp. nov. with the other five species of the genus *Haemadipsa* in India.

	<i>Haemadipsa anaigundiensis</i> sp. nov.	<i>H. dussumier</i>	<i>H. moorei</i>	<i>H. montana</i>	<i>H. ornata</i>	<i>H. sylvestris</i>
Stripe	Complete, from first pair of eyes to the base of posterior sucker	No stripe	Complete, black, chain strip, from the bottom of first pair of eyes to the base of posterior sucker	Complete, black, number of stripe three	Complete, black, creamed coloured, number of stripe three	Complete, black, number of stripe three
Marginal stripe	creamed coloured	Absent	Complete yellow coloured	Complete pale yellow coloured	Complete creamed coloured	Complete bright orange
Colour	Ash green (in living)	Yellowish mottled black	Dark	Dark	Velvately black	Blakish brown
Body length	7 mm	—	—	—	—	—
Breadth	4 mm	—	—	—	—	—
Breadth of anterior sucker	.5 mm	—	—	—	—	—
Breadth of posterior sucker	1 mm	—	—	—	—	—

Table (Cont'd.).

	<i>Haemadipsa anaigundiensis</i> sp. nov.	<i>H. dussumier</i>	<i>H. moorei</i>	<i>H. montana</i>	<i>H. ornata</i>	<i>H. sylvestris</i>
Clitellum	Not prominent	prominent	prominent	prominent	prominent	prominent
Breeding season	–	–	–	June-July	June-July	May-July
Eggs	–	–	–	5-7	3-7	13-15
Stomach	More than seven chambered	One chambered	–	–	–	–
Caeca	Short, more than three pairs	three pairs, short	–	–	–	–
Crop	Not branched	Almost branched	–	–	–	–
Vaginal stalk	Short	Long	–	–	–	–
Caecum	Present	Present	–	–	–	–
Altitude	3000 mts.	1200 mts.	1500-1800 mts.	3000 mts.	3000 mts.	1500-2000 mts.
Reference	Blanchard, 1894	Blanchard, 1917	Moore, 1927	Moore, 1927	Sanjeva Raj and Gladstone, 1981	Present author

SUMMARY

A new species of leech *Haemadipsa anaigundiensis* is described from Tamil Nadu. It is distinguished in possessing the following characters. One black stripe is on the median dorsal region, from the base of the posterior sucker to the first pair of eyes. Eyes five pairs. Six pairs of white papillae are on the dorsum. Lateral side bear one pair of cream coloured line. The leech is as green in living and ash or brownish black in preserved condition. Both the dorsal and ventral regions bear black spots. Length of a full-grown preserved specimen is 7 mm and width is 4 mm. Posterior sucker is 1 mm in diameter; anterior sucker measures 5 mm diameter. A living specimen becomes double in length in full extension.

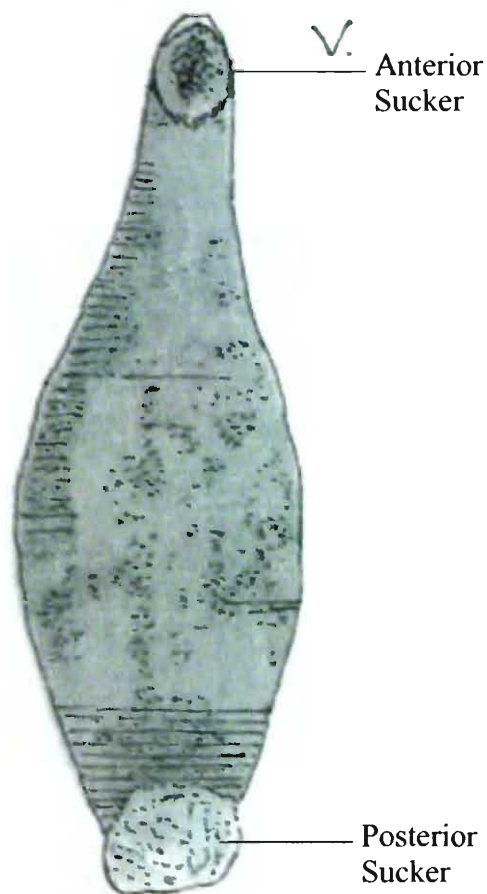
ACKNOWLEDGEMENTS

Thanks are due to Director Zoological Survey of India for extending facilities to carry out the work. My sincere thanks are also due to Dr. A. Misra, Officer-in-charge (Retired), General Non-Chordata Section and Dr. CH. Satyanarayana, Z.S.I., Kolkata for their kind assistance.

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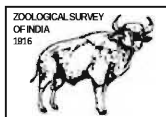
Haemadipsa aneigundiensis



(After preservation)
Haemadipsa aneigundiensis



(In living)
Haemadipsa aneigundiensis



Rec. zool. Surv. India : **109**(Part-3) : 33-36, 2009

FIRST REPORT OF THE OCCURRENCE OF SOME RARE BUTTERFLIES (LEPIDOPTERA : RHOPALOCERA) FROM CHHATTISGARH, CENTRAL INDIA

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INTRODUCTION

The State of Chhattisgarh in Central India was carved out from Madhya Pradesh in the year 2000. It lies between latitudes 17° 46' to 20° 34' N latitude and 80°18' to 82°15' E longitude, covering an area of 1,35,194 sq. km comprising of 16 districts and shares its borders with Madhya Pradesh on the northwest, Maharashtra on the west, Andhra Pradesh on the South, Orissa on the east, Jharkhand on the northeast and Uttar Pradesh on the north.

During the course of a general faunistic survey conducted in the Kangerghati National Park (18° 45' to 18° 56'30'' N and 81°51'30'' to 82° 10' E), Dist. Bastar, Chhattisgarh, during March 2007, the two species of butterflies dealt with below were encountered. A perusal of literature especially Chandra *et al.* (2007) revealed that the occurrence of those two species was not yet reported from Central India. Thus, they constitute new records for Central India in general and Chhattisgarh in particular. Both the species are very rare locally and even in the areas of their distribution elsewhere.

Family NYMPHALIDAE

Subfamily APATURINAE

1. *Euripus consimilis* (Westwood, 1850)

The Painted Courtesan

(Plate-I, 1 & 2)

The genus *Euripus* Westwood includes two Indian species, *E. consimilis* Westwood and *E. nyctelius* Doubleday. Both the species are rare and categorized as endangered.

Material examined : 1G Kotamsar Gufa and around, 15.iii.2007; 1G Jagdaghat, 16.iii.2007; 1G Champal Nallah, Kangerghati National Park, Dist. Bastar, Chhattisgarh, 17.iii.2007, R.M. Sharma Coll.

Diagnosis : Wing expanse : 60-85 mm G : upperside, forewing black with broad white streaks and spots; which includes a long white streak from the base in area 1, a slender streak in the cell,

a broad, oblique median band followed by a row of paired white streaks in interspaces 3, 4 and 5; a post-discal series of slender streaks. A terminal row of white dots, elongated into streaks towards the apex. Hindwing white traversed by black veins. Termen black with a subterminal row of four or five crimson spots posteriorly and beyond this a regular terminal row of white spots. Underside bears crimson basal markings. E : Similar to the male, except that the upperside of the hindwing, clear white or crimson-coloured and the tornal red spots are absent. Basal crimson patch on the underside of the hindwing present. The antennae black, the head, thorax and abdomen black and marked with white beneath.

Food plants : *Trema orientalis* (Urticaceae) and *Albizzia stipulata* (Leguminosae).

Distribution : India : *South India* (Western Ghats) : Goa, Karnataka, Kerala and Maharashtra (Goankar, 1996). *Central India* : Present record from Chhattisgarh. *North India* : East from Dehra Dun (Wynter Blyth, 1957, Haribal., 1992). *North East India* : Assam, Sikkim (Wynter Blyth, 1957, Haribal., 1992). *East India* : West Bengal (Jalpaiguri, Buxa) (ZSI, Envis Center), Jeypore (Eastern Ghats, Wynter Blyth, 1957). *Elsewhere* : Indonesia (Sundaland), Myanmar, Nepal, N. Thailand (Varshney, 1994).

Conservation Status : Rare. Placed under Schedule II, Part II of IWPA (1972).

Remarks : The Painted Courtesan frequents dense jungles and can be found widely distributed in the regions of moderate to heavy rainfall and low elevation. Males have a weak, fluttering flight like day -flying moths of the family *Zygaenidae* and may be seen resting with wings partially open. The flight and habits of females resemble that of the Danaids especially the Crows. It visits *Lantana* flowers.

Family PIERIDAE

Subfamily COLIADINAE

2. *Gandaca harina* (Horsfield, 1829)

The Tree Yellow

(Plate-I, 3 & 4)

The monotypic genus *Gandaca* is represented by a single species in India with three subspecies viz. *andamana* Moore, *assamica* Moore and *nicobarica* Evans.

Material examined : 1G, Champal Nallah, 17.iii.2007, Kangerghati National Park, Dist. Bastar, Chhattisgarh, R.M. Sharma Coll.

Diagnosis : Wing expanse : 35-45 mm G : Yellow and E : White above, both absolutely unmarked except for the black apex and termen on the forewing.

Distribution : India : Andaman & Nicobar Islands, Assam, Chhattisgarh (Present record) and Sikkim. *Elsewhere* : Myanmar.

Remarks : This species occurs in the wet forested areas of low elevations and can be found fluttering in shaded areas in association of Grass Yellows to which it shows close resemblance. Males do visit flowers. The subspecific status of the population occurring in Central India can be ascertained on getting more specimens.

ACKNOWLEDGEMENTS

The authors are thankful to Dr. Ramakrishna, Director, Zoological Survey of India, Kolkata for facilities and to the scientific staff of this station for their active co-operation during the field work. We are also thankful to Shri. M.E.Limje, Photographer for taking the photographs.

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PLATE -I



1. *Euripus consimilis* (Westwood) (Upperside) ♂



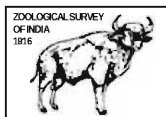
2. *Euripus consimilis* (Westwood) (Upperside) ♂



3. *Gandaca harina* ((Housefield) (Upperside) ♂



4. *Gandaca harina* ((Housefield) (Upperside) ♂



Rec. zool. Surv. India : **109**(Part-3) : 37-40, 2009

TAXONOMIC STUDIES OF THE HOVER WASPS (HYMENOPTERA : VESPIDAE; STENOGASTRINAE) OF ARUNACHAL PRADESH, INDIA

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INTRODUCTION

The hover wasps belong to the subfamily Stenogastrinae is a group of primitive eusocial wasps endemic to the Oriental Region. Currently 57 species are reported under 7 genera even though one species namely *Cochlischnogaster menglunensis* Dong & Otsuka is kept uncertain by Carpenter, 2001 (Carpenter & Kojima, 1996; Dong & Otsuka, 1997; Carpenter & Nguyen, 2003; Saito *et al.*, 2006; Saito & Kojima, 2007).

The genus *Eustenogaster* Van der Vecht consists of 4 species from Indian subcontinent namely *E. eximia eximia* (Bingham) from Sri Lanka, *E. eximia eximioides* (Dover & Rao) from India (Kerala and Tamil Nadu), *E. fraterna* (Bingham) from India (Assam and Sikkim) and Myanmar, *E. hauxwellii* (Bingham) from India (Sikkim) and Myanmar and *E. scitula* (Bingham) from India (Assam, Meghalaya and Sikkim) and Myanmar. The genus *Parischnogaster* Von Schulthess consists of only one species namely *P. mellyi* (de Saussure) from India (Assam, Meghalaya and Sikkim) and Myanmar (Das & Gupta, 1989; Carpenter & Kojima, 1996; Saito & Kojima, 2007). The subfamily Stenogastrinae is not recorded from Arunachal Pradesh till date (Kundu *et al.*, 2006). Hence in this paper we record two species of hover wasps namely *Eustenogaster scitula* (Bingham) and *Parischnogaster mellyi* (de Saussure) from Arunachal Pradesh for the first time.

MATERIALS AND METHODS

All the specimens were collected by using sweep net. The collected specimens were killed by using ethyl acetate and preserved as dry specimens. The pinned specimens were subjected to taxonomic studies by using Wild Heerbrugg Stereozoom microscope and drawings were made.

All the materials examined have been received on loan from Arunachal Pradesh Field Station of Zoological Survey of India (APFS/ZSI) at Itanagar and eventually will be deposited at the same station.

Detailed synonymical references are published by Carpenter & Kojima (1996). So we have not mentioned all the synonyms of the species in this paper.

SYSTEMATIC ACCOUNT

- Family VESPIDAE
 Subfamily STENOGASTRINAE
 Genus *Eustenogaster* van der Vecht
 1. *Eustenogaster scitula* (Bingham)
 Genus *Parischnogaster* Von Schulthess
 2. *Parischnogaster mellyi* (de Saussure)

RESULTS

1. *Eustenogaster scitula* (Bingham)

(Figs. 1 & 2; Plate-I)

1897. *Ischnogaster scitula* Bingham. *Fauna Brit. India, Hym.* 1 : 377 (Key), 379, female—"Rangit Valley, Sikkim; Margherita, Assam" (London).

1983. *Eustenogaster scitula* (Bingham): Das & Gupta. *Oriental Ins.* 17: 402. cat., syn., ref., distr.

Diagnosis : Female : Length 16-20 mm. Body black. Yellow markings as follows : A large mark on clypeus, propodeum with one circular small yellow mark on each side at apex, a line on fore tibia below, an elongated mark on each side of third gastral segment basally. Yellowish brown markings as follows : pronotum with an apical band interrupted in middle and not reaching tegula; a large mark on mesepisternum ventrally. Legs largely and gastral petiole laterally and ventrally with reddish tinct. Wings fusco-hyaline and iridescent. Body covered with silvery pubescence; supraclypeal area reticulate; interantennal space, frons, vertex up to posterior ocelli, pronotum on sides, mesoscutum, scutellum, mesepisternum above dorsal episternal groove and mesepimeron rugoso-reticulate. Vertex behind posterior ocelli with close large and small punctures. Pronotum smooth with moderately close deep punctures; postscutellum, dorsal and ventral metapleuron and propodeum with fine close superficial punctures.

Male : Length 16- 18.5 mm. Male differs from female in having mandible apically rounded with distinct blunt tooth (Figs. 1, 2).

Variations : The female and male specimens studied in this paper are showing the following variations from the descriptions provided by Das & Gupta (1989) : (1) Length : Female : 20 mm; Fore wing : 12 mm (in Das & Gupta, Female : 16- 17 mm; Fore wing : 15- 16 mm); (2) Length : Male : 18.5 mm; Fore wing : 12.5 mm (in Das & Gupta, Male : 16 mm; Fore wing : 15-16 mm); (3) Clypeus with a large yellow mark (in Das & Gupta, clypeus with a small yellow spot); (4) A

Figs. 1-2. : *Eustenogaster scitula* (Bingham)

Fig. 1 : Female. Apex of right mandible showing teeth.

Fig. 2. : Male. Apex of left mandible showing teeth.

yellow line present on distal fore tibia (in Das & Gupta, no yellow line on distal fore tibia). All other characters are similar to the description provided by Das & Gupta (1989).

Distribution : India (Arunachal Pradesh, Assam, Meghalaya and Sikkim).

Elsewhere : Malaysia and Myanmar.

Material examined : 1 Female, India, Arunachal Pradesh; Papumpare Dist.; Hathi Nallah Doimukh, 29.vi. 2005, coll. G. Srinivasan, Reg. No. 10/Inv. (APFS/ZSI). 1 Male, India, Arunachal Pradesh; West Siang Dist.; Payum village, 4.xii.2003, coll. G. Srinivasan, Reg. No. 11/Inv. (APFS ZSI).

Remarks : This forms the first report of this species from Arunachal Pradesh.

2. *Parischnogaster mellyi* (de Saussure)

(Plate-II)

1852. *Ischnogaster mellyi* de Saussure. *Ann. Soc. Ent. France*. (2) 10 : 25, Pl. 2, Fig. 1, Male : "Java" (Geneva).

1927. *Parischnogaster mellyi* (de Saussure) : von Schulthess. *Suppl. Ent.* 16 : 82, 87.

Diagnosis : Female : Length 10-11.5 mm. Head black, thorax dark brown. Yellow markings are : mandible (except basal area and teeth reddish), antennal scape below, interrupted band on pronotal collar, broad apical uninterrupted band on pronotum, two oval marks at base and a circular mark at apex of mesoscutum, two circular marks on scutellum, a band on post scutellum at base, two marks on mesepisternum, one on dorsal metapleuron, two circular marks on propodeum at apex, a mark on fore and mid femora apically, a line below fore and mid tibia. Antenna, pronotum, mesopleuron and metapleuron (except the yellow marks), sides of propodeum, legs (except yellow marks) reddish brown. Gaster reddish brown. Yellow portions are: one short line on gastral petiole on sides towards apex, another on the side of petiolate second gastral tergite, two vertical lines on second gastral sternite on sides, third to sixth sternites with large marks on sides. Body narrow covered with fine silvery pubescence. Clypeus with a characteristic pointed tooth apically, basal two- thirds reticulato-rugose, apical one- third with a few scattered large punctures; supraclypeal area, interantennal space, frons, vertex up to posterior ocelli, mesoscutum, scutellum, mesopleuron almost entirely rugoso-reticulate; inner orbit, ocular sinus almost smooth. Postscutellum with a few punctures in the middle; metapleuron with a few punctures in the middle; metapleuron mat; propodeum with irregular narrow striations and narrow but distinct median groove. Gastral petiole long, strongly swollen towards apex, slightly narrowed again at apex; maximum width of gaster lies at both second and third gastral segment.

Variations : The female specimens studied in this paper are showing the following variations from the descriptions provided by Das & Gupta (1989) : (1) Length 11.5-12 mm. (in Das & Gupta, 10 mm); (2) Head black (in Das & Gupta, head dark brown); (3) Clypeus entirely black (in Das & Gupta, clypeus with a yellow mark on apex); (4) Mandibles yellow except basal area and teeth reddish (in Das & Gupta, mandibles yellow except reddish teeth); (5) Fore coxa in front entirely brown (in Das & Gupta, fore coxa in front almost entirely yellow). All the other characters are similar to the description provided by Das & Gupta (1989).

Distribution : India (Arunachal Pradesh, Assam, Meghalaya and Sikkim).

Elsewhere : Indonesia, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam.

Material examined : 2 Female, India, Arunachal Pradesh; Papumpare Dist.; Itanagar, 20.ii.2005, coll. G. Srinivasan, Reg. Nos. 12/Inv. (APFS/ZSI) & 13/Inv. (APFS/ZSI).

Remarks : This forms the first report of this species from Arunachal Pradesh.

SUMMARY

This paper deals with the hover wasps of Arunachal Pradesh. This forms the new record of the subfamily Stenogastrinae with 2 species under 2 genera from the state.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. Ramakrishna, Director, Zoological Survey of India, Kolkata for providing facilities and encouragements and to Dr. James M. Carpenter, American Museum of Natural History, New York for providing some valuable reprints of his recent papers. The second author is also grateful to Dr. S.I. Kazmi, Officer-in-Charge, Hymenoptera Section, Zoological Survey of India, Kolkata for providing facilities.

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PLATE -I

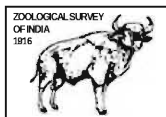


Eustenogaster scitula (Bingham) Female

PLATE -II



Parischnogaster mellyi (de Saussure) Female



Rec. zool. Surv. India : **109**(Part-3) : 41-60, 2009

BIODIVERSITY AND DISTRIBUTION OF FRESHWATER ROTIFERS (ROTIFERA : EUROTATORIA) OF TAMIL NADU

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INTRODUCTION

Taxonomic studies on freshwater Rotifera of Tamil Nadu were initiated by Edmondson and Hutchinson (1934); about two dozen papers published during the time span of more than seven decades indicate that their faunal diversity is still inadequately explored. A large number of earlier works, however, deal with scattered reports of various taxa or record only planktonic species. The detailed faunal surveys from this state are yet lacking while samples from certain districts are examined by Daisy (2001) and Sivakumar and Altaff (2001). Raghunathan and Suresh Kumar (2006) compiled a list of the rotifers reported from Tamil Nadu based on the published literature; it reflects several nomenclatural anomalies, incorrect family allocations, obsolete names and records requiring confirmation and, hence, requires a critical analysis.

The present study, a part of our investigations on Fauna volume of Indian Freshwater Rotifera, documents 139 species (149 taxa) belonging to 38 genera and 20 families from Tamil Nadu and, includes 38 new records from this state and 20 new reports from the southern India. This study raises the micro-faunal diversity of Tamil Nadu Rotifera to 177 species (188 taxa); an up-dated systematic inventory is presented and, various interesting species are briefly diagnosed and illustrated. Remarks are made on nature and composition of the rotifer fauna of Tamil Nadu as well as on the biodiversity observed in the collections examined by the authors. In addition, comments are made on biogeographically important elements, occurrence and distribution of interesting species, taxonomic status of several taxa and validity of various earlier records.

MATERIALS AND METHODS

A total of 248 plankton samples collected from the following localities, spread over nine districts, of Tamil Nadu (Fig. 1, A-B) were examined in the present study :

Northern Tamil Nadu

Tiruvallur (13° 09' N; 79° 57' E)
 Chennai (13° 04' N; 80° 17' E)
 Vellore (12° 55' N; 79° 11' E),
 Kanchipuram (12° 50' N; 79° 45' E)
 Tiruvannamalai (12° 15' N; 79° 07' E)
 Dharamapuri (12° 08' N; 78° 13' E)
 Salem (11° 39' N; 78° 12' E)

Southern Tamil Nadu

Madurai (9° 58' N 78° 10' E)
 Virudunagar (9° 35' N; 77° 57' E)
 Tuticorin (8° 48' N; 78° 11' E)

The qualitative plankton samples were collected, on several occasions during 2005-2007, from various aquatic biotopes of the stated localities and their environs by nylobolt plankton net (No. 25) and were preserved in 5% formalin. Individual collections were screened with a Wild stereoscopic binocular microscope for isolation of different taxa. Permanent mounts of various species were prepared in Polyvinyl alcohol-lectophenol mixture. Illustrations of different taxa were drawn with a Leitz-Dialux phase contrast stereoscopic microscope using a drawing-tube attachment. All the measurements were given in micrometers (μm).

Rotifera species are identified following the works of Kutikova (1970), Koste (1978), Koste and Shiel (1987, 1989, 1990, 1991), Shiel and Koste (1992, 1993), Segers (1995), De Smet (1997), Sharma (1983, 1987, 1998b), Sharma and Sharma (1997, 1999, 2000), Nogrady and Pourriot (1995) and Nogrady and Segers (2002). The system of Rotifera classification followed in this account is after Segers (2002) and the remarks on their biogeography are made following Segers (2007). The percentage similarities between the rotifer communities are calculated by Sorenson's index. All the collections and reference materials are deposited in the holdings of the senior author (BKS) at Department of Zoology, North-Eastern Hill University, Shillong.

SYSTEMATIC ACCOUNT

One hundred seventy-seven species (188 taxa) of Rotifera, belonging to 56 genera and 25 families are recorded presently from Tamil Nadu. Of these, 139 species (149 taxa), spread over 38 genera and 20 families, are observed in the collections examined by the authors. A detailed systematic list of the recorded taxa is presented in Table 1 and their family-wise break-up is indicated in Table 2.

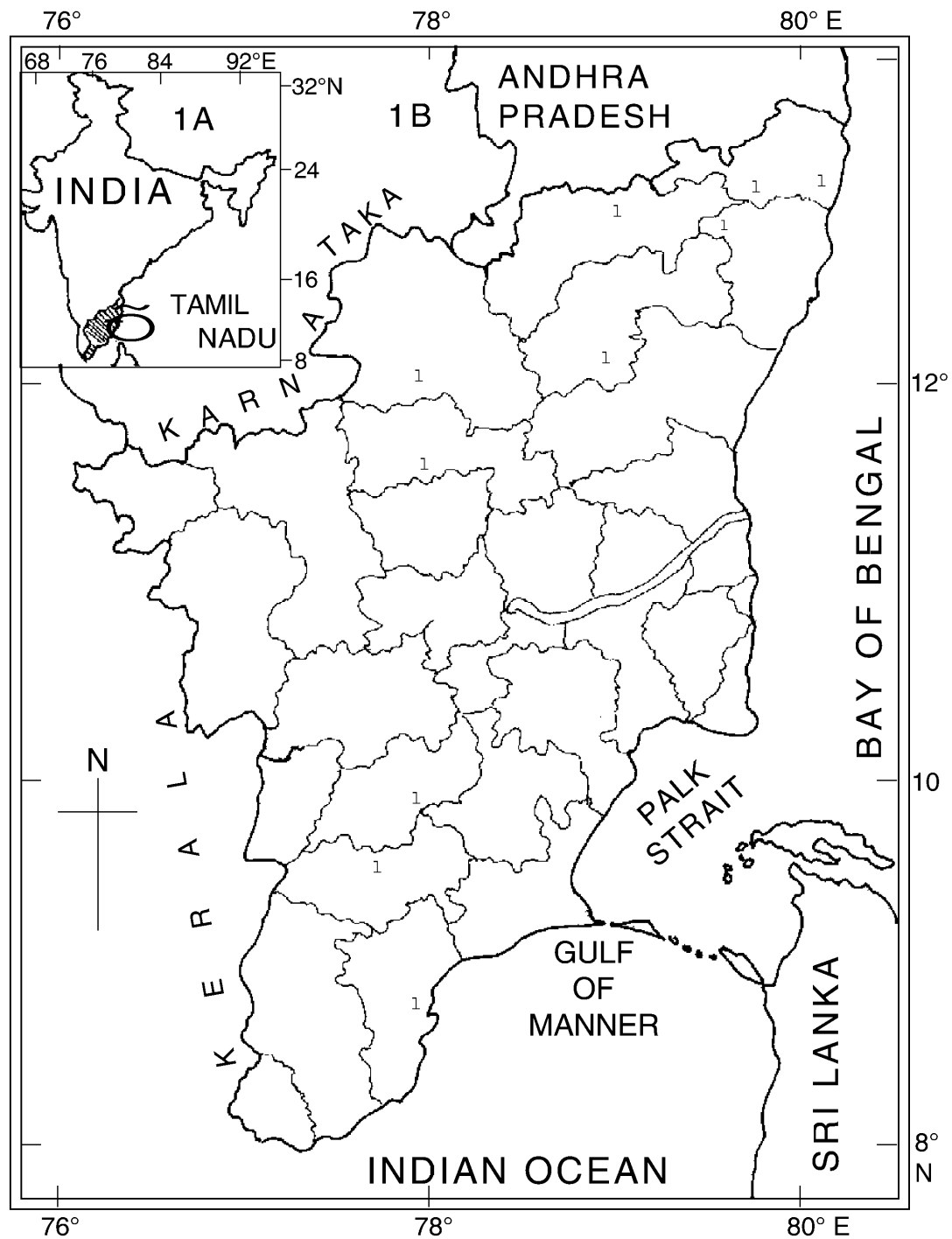


Fig. 1 : A (inset) : Map of India indicating location of Tamil Nadu; Fig. 1, B : Map of Tamil Nadu indicating sampled localities.

Table 1 : Systematic list of reported Rotifera taxa

Sr. No.	Families	Total taxa reported (present study)		Taxa examined in our collections	
		Species	Genera	Species	Genera
1	Brachionidae	31	6	27	5
2	Epiphanidae	4	1	1	1
3	Euchlanidae	9	5	5	3
4	Mytilinidae	3	2	3	2
5	Trichotriidae	5	3	4	2
6	Lepadellidae	19	3	19	3
7	Lecanidae	40	1	36	1
8	Proalidae	1	1	0	0
9	Notommatidae	9	5	5	3
10	Scaridiidae	1	1	1	1
11	Gastropodidae	2	2	1	1
12	Trichocercidae	12	1	12	1
13	Asplanchnidae	5	2	2	1
14	Synchaetidae	5	4	3	2
15	Dicranophoridae	3	3	1	1
Order FLOSCULARIACEAE					
16	Flosculariidae	3	2	3	2
17	Conochilidae	2	1	2	1
18	Hexarthridae	2	1	1	1
19	Trochosphaeridae	7	3	7	3
20	Testudinellidae	4	2	4	2
Order COLLOTHECACEAE					
21	Collothecidae	1	1	0	0
22	Atrochidae	1	1	0	0
Order Bdelloidea					
23	Adinetidae	1	1	0	0
24	Habrotrochidae	1	1	0	0
25	Philodinidae	6	3	2	1
	Total taxa	177	56	139	38

Besides, some taxa with uncertain taxonomic status (*refer* Koste, 1978, Sharma, 1998a, Segers, 2007) reported from Tamil Nadu have been grouped into the following categories :

Genera and species inquirendae
Diplois daviesiae Gosse, 1886
Pseudoembata acutipoda Wycliffe & Michael, 1968
Species inquirendae
Conochilus arboreus Rajendran, 1971
C. madurai Michael, 1966

Table 2 : Family-wise break-up of the Rotifer fauna of Tamil Nadu.

Sr. No.	Families	Total taxa reported (present study)		Taxa examined in our collections	
		Species	Genera	Species	Genera
Order	PLOIMA				
1	Brachionidae	31	6	27	5
2	Epiphanidae	4	1	1	1
3	Euchlanidae	9	5	5	3
4	Mytilinidae	3	2	3	2
5	Trichotriidae	5	3	4	2
6	Lepadellidae	19	3	19	3
7	Lecanidae	40	1	36	1
8	Proalidae	1	1	0	0
9	Notommatidae	9	5	5	3
10	Scardiidae	1	1	1	1
11	Gastropodidae	2	2	1	1
12	Trichocercidae	12	1	12	1
13	Asplanchnidae	5	2	2	1
14	Synchaetidae	5	4	3	2
15	Dicranophoridae	3	3	1	1
Order	FLOSCULARIACEAE				
16	Flosculariidae	3	2	3	2
17	Conochilidae	2	1	2	1
18	Hexarthridae	2	1	1	1
19	Trochosphaeridae	7	3	7	3
20	Testudinellidae	4	2	4	2
Order	COLLOTHECACEAE				
21	Collothecidae	1	1	0	0
22	Atrochidae	1	1	0	0
Order	BDELLOIDEA				
23	Adinetidae	1	1	0	0
24	Habrotrochidae	1	1	0	0
25	Philodinidae	6	3	2	1
	Total taxa	177	56	139	38

TAXONOMIC NOTES

Various interesting species examined in the present study as well as certain interesting elements reported earlier from Tamil Nadu are briefly commented and illustrated below :

Family BRACHIONIDAE

***Brachionus donneri* Brehm, 1951**

Material examined : 5 examples, R/BKS/TN/08-12, Vandiyur tank, Madurai, 24.05.2006, coll. S. Krishnan; 3 examples, R/BKS/TN/13-15, pond close to Kuvum river, near NH-4, Chennai, 12.01.2007, coll. B.K. Sharma.

Distribution : India : Assam, Meghalaya, Tripura, West Bengal and Tamil Nadu.

Elsewhere : Oriental region.

***Brachionus durgae* Dhanapathi, 1974**

Material examined : 3 examples, R/BKS/TN/16-18, wetland located east of Tiruvallur, vicinity of NH-205, 08.01.2007, coll. B.K. Sharma.

Distribution : India : Andhra Pradesh and Orissa.

Elsewhere : African, Neotropical, Oriental and Palearctic regions.

Remarks : This species is reported first time from Tamil Nadu.

***Keratella edmondsoni* Ahlstrom, 1943**

Material examined : 3 examples, R/BKS/TN/31-33, pond in Poondi, Tiruvallur district, 09.01.2007, coll. B.K. Sharma; 2 examples, R/BKS/TN/34-35, wetland located north of Tiruvannamalai towards Turinjapuram, 31.06.2007, coll. A. Rajan.

Distribution : India : Assam, Rajasthan and Orissa.

Elsewhere : Oriental region.

***Keratella lenzi* Hauer, 1953**

Material examined : 4 examples, R/BKS/TN/36-39, Vardaraja temple pond, Kanchipuram, 14.01.2007, coll. B.K. Sharma; 3 examples, R/BKS/TN/40-42, wetland located south of Salem towards Mallur, 22.08.2005, coll. A. Vijayan.

Distribution : India : Assam, Meghalaya, Tripura, West Bengal, Orissa and Punjab.

Elsewhere : Pantropical.

Remarks : This species is reported first time from southern India.

***Platylabus leloupi* (Gillard, 1967)**

Material examined : 2 examples, R/BKS/TN/50-51, wetland located north of Vellore towards Katpadi, 07.09.2005, coll. A. Vijayan.

Distribution : India : Assam and Kerala.

Elsewhere : Tropicopolitan.

Remarks : This species is reported first time from Tamil Nadu.

Family EUCHLANIDAE

Pseudoeuchlanis longipedes Dhanapathi, 1978

Material examined : not observed in the examined collections.

Characters : Body ovoid, truncate anterior at end and rounded posteriorly. Dorsal plate arched in cross-section, with anterior margin raised in middle into a small arched and non-retractable semicircular plate. Venter membranous, its posterior portion stiffened. Lateral sulci absent. Toes long. Slender, cylindrical, slightly broad at base and with tips curved outwards. Mastax modified malleate type.

Distribution : India : Andhra Pradesh.

Elsewhere : Endemic to India.

Remarks : This species is reported first time from Tamil Nadu.

Family MYTILINIDAE

Mytilina acanthophora Hauer, 1938

Material examined : 3 examples, R/BKS/TN/63-65, wetland located in Vedantagdal Bird sanctuary, Kanchipuram district, 15.01.2007, coll. B.K. Sharma; 2 examples, R/BKS/TN/66-67, wetland located near Virudunagar towards Palavanattam, 02.06.2007, coll. N. Murugan.

Distribution : India : Assam, West Bengal and Punjab.

Elsewhere : Pantropical.

Remarks : This species is reported first time from southern India.

Family TRICHOTRIIDAE

Macrochaetus longipes (Myers, 1934)

Material examined : 3 examples, R/BKS/TN/71-73, wetland located in Vedantagdal Bird sanctuary, Kanchipuram district, 15.01.2007, coll. B.K. Sharma.

Distribution : India : Assam and Meghalaya.

Elsewhere : Cosmopolitan.

Remarks : This species is reported first time from southern India.

Family LEPADELLIDAE

Lepadella biloba Hauer, 1958

Material examined : 2 examples, R/BKS/TN/80-81, wetland located north of Vellore towards Katpadi, 07.09.2005, coll. A. Vijayan; 2 examples, R/BKS/TN/82-83, wetland located east of Dharmapuri towards Mukhamur, 02.08.2006, coll. M. George; 3 examples, R/BKS/TN/84-86, paddy-field located in outskirt of Kanchipuram, 14.01.2007, coll. B.K. Sharma.

Distribution : India : Meghalaya.

Elsewhere : Cosmopolitan.

Remarks : This species is reported first time from southern India.

***Lepadella dactyliseta* (Stenroos, 1898)**

Material examined : 3 examples, R/BKS/TN/94-96, wetland located south of Salem towards Mallur, 22.08.2005, coll. A. Vijayan.

Distribution : India : Assam, Meghalaya and Kerala.

Elsewhere : Palaeotropical.

Remarks : This species is reported first time from Tamil Nadu.

***Lepadella eurysterna* Myers, 1942**

Material examined : 2 examples, R/BKS/TN/99-100, wetland located 5 km north of Tuticorin, 05.09.2005, coll. T. Jayaraman; 3 examples, R/BKS/TN/101-103, wetland located near Virudunagar towards Palavanattam, 02.06.2007, coll. N. Murugan; 2 examples, R/BKS/TN/104-105, paddy field located near Pennathur, Tiruvannamalai district, 31.06.2007, coll. A. Rajan.

Distribution : India : Meghalaya and Delhi.

Elsewhere : Cosmopolitan.

Remarks : This species is reported first time from southern India.

Family LECANIDAE

***Lecane braumi* Koste, 1978**

Material examined : 3 examples, R/BKS/TN/122-125, wetland located in Maninagaram, Madurai, 25.05.2005, coll. S. Krishnan; 2 examples, R/BKS/TN/126-127, paddy-field located near Ambattur, Virudunagar district, 02.06.2007, coll. N. Murugan.

Distribution : India : Assam, Tripura and Tamil Nadu.

Elsewhere : Palaeotropical.

***Lecane eswari* Dhanapathi, 1976**

Material examined : 3 examples, R/BKS/TN/133-135, wetland located east of Tiruvallur and in the vicinity of NH-205, 08.01.2007, coll. B.K. Sharma.

Distribution : India : Andhra Pradesh and Chandigarh (Union Territory).

Elsewhere : Palaeotropical.

Remarks : This species is reported first time from Tamil Nadu.

***Lecane lateralis* Sharma, 1978**

Material examined : 4 examples, R/BKS/TN/141-144, wetland located near Adyar river in the vicinity of Nandanam, 12.01.2007, coll. B.K. Sharma; 3 examples, R/BKS/TN/145-147,

Ekambareswarar temple pond, Kanchipuram, 14.01.2007, coll. B.K. Sharma; 3 examples, R/BKSTN/148-150, wetland located in outskirts of Salem towards Surnamanglam, 22.08.2006, coll. A. Vijayan.

Distribution : India : Assam, Meghalaya, Tripura, Orissa and West Bengal.

Elsewhere : Palaeotropical.

Remarks : This species is reported first time from southern India.

Lecane simonneae Segers, 1993

Material examined : 3 examples, R/BKS/TN/168-170, wetland located in Vedantagdal Bird sanctuary, Kanchipuram district, 15.01.2007, coll. B.K. Sharma.

Distribution : India : Assam, Kerala and Tamil Nadu.

Elsewhere : Palaeotropical.

Lecane sola Hauer, 1936

Material examined : 4 examples, R/BKS/TN/171-174, wetland located in outskirts of Tuticorin vicinity of NH-7A, 05.09.2005, coll. T. Jayaraman; 3 examples, R/BKS/TN/175-177, wetland located near Virudunagar towards Palavanattam, 02.06.2007, coll. N. Murugan.

Distribution : India : Assam, Tripura and Tamil Nadu.

Elsewhere : Tropics and subtropics.

Lecane (Monostyla) acanthinula (Hauer, 1938)

Material examined : 3 examples, R/BKS/TN/181-184, wetland located in outskirts of Tuticorin in the vicinity of NH-7A, 05.09.2005, coll. T. Jayaraman.

Distribution : India : Assam, Tripura, Kerala and Orissa.

Elsewhere : Oriental region.

Remarks : This species is reported first time from Tamil Nadu.

Lecane (Monostyla) bulla diabolica (Hauer, 1936)

Material examined : not observed in the examined collections.

Characters : Lorica smooth, egg-shaped, without clear distinction between dorsal and ventral plates and with dorsal plate with a pair of characteristic anteriorly directed spines. Toe long, parallel-sided; claw relatively long.

Distribution : India : Tamil Nadu.

Elsewhere : Endemic to India.

Family GASTROPODIDAE

Ascomorpha ecaudis (Perty, 1850)

Material examined : 3 examples, R/BKS/TN/221-223, Kunnathur tank, Madurai, 24.05.2006, coll. S. Krishnan.

Distribution : India : Kashmir and Manipur.

Elsewhere : Cosmopolitan.

Remarks : This species is reported first time from southern India.

Family TRICHOCERCIDAE

***Trichocerca bicristata* (Gosse, 1887)**

Material examined : 4 examples, R/BKS/TN/227-231, wetland located in Pudapet, Chennai, 12.01.2007, coll. B.K. Sharma.

Distribution : India : Assam, Bihar and Orissa.

Elsewhere : Cosmopolitan.

Remarks : This species is reported first time from southern India.

***Trichocerca iernis* (Gosse, 1887)**

Material examined : 3 examples, R/BKS/TN/236-238, paddy-field located in outskirts of Vellore, 07.09.2005, coll. A. Vijayan.

Distribution : India : Assam and Kashmir.

Elsewhere : Cosmopolitan.

Remarks : This species is reported first time from southern India.

***Trichocerca kostei* Segers, 1993**

Material examined : 3 examples, R/BKS/TN/239-241, paddy field located near Poondi, Tiruvallur district, 18.07.2005, coll. A. Rajan.

Distribution : India : Assam and Kerala.

Elsewhere : Palaeotropical.

Remarks : This species is reported first time from Tamil Nadu.

***Trichocerca similis grandis* Hauer, 1965**

Material examined : 3 examples, R/BKS/TN/250-252, wetland located north of Vellore towards Katpadi, 07.09.2005, coll. A. Vijayan; 4 examples, R/BKS/TN/253-256, Vandiyur tank, Madurai, 24.05.2006, coll. S. Krishnan; 4 examples, R/BKS/TN/257-260, wetland located in Vedantagdal Bird sanctuary, Kanchipuram district, 15.01.2007, coll. B.K. Sharma.

Distribution : India : Assam.

Elsewhere : African, Australian and Neotropical regions.

Remarks : This species is reported first time from southern India.

Family ASPLANCHNIDAE

***Asplanchnopus bhimavaramensis* Dhanapathi, 1971**

Material examined : not observed in the examined collections.

Characters : Body transparent, thin, sacciform; head separated from body. Corona as a circum-apical band of cilia. Retro-cerebral sac with a prominent eye. Mastax incudate, with short fulcrum, ramus without teeth on inner side, uncus reduced and attached to delicate trifid manubria. Vitellarium horse-shoe shaped. Flame cells 16-18. Gastric glands round. Foot glands long and club shaped. Foot two jointed; basal segment stout and terminal segment long and wrinkled. Toes broad at base and gradually tapering to conical tips.

Distribution : India : Andhra Pradesh.

Elsewhere : Endemic to India.

Family DICRANOPHORIDAE

***Dicranophoroides caudatus* (Ehrenberg, 1834)**

Material examined : 2 examples, R/BKS/TN/287-288, paddy field located in outskirt of Tuticorin, 04.09.2005, coll. T. Jayaraman; 2 examples, R/BKS/TN/289-290, wetland located west of Tiruvannamalai towards Pennathur (NH-86), 31.06.2007, coll. A. Rajan.

Distribution : India : Assam and Andhra Pradesh.

Elsewhere : Cosmopolitan.

Remarks : This species is reported first time from Tamil Nadu.

Order FLOSCULARIACEAE

Family FLOSCULARIDAE

***Sinantherina spinosa* (Thorpe, 1893)**

Material examined : 2 examples, R/BKS/TN/299-300, paddy-field located in outskirt of Virudunagar, 01.06.2007, coll. N. Murugan; 2 examples, R/BKS/TN/301-302, wetland located west of Tiruvannamalai towards Pennathur (NH-86), 31.06.2007, coll. A. Rajan.

Distribution : India : Assam and Tripura.

Elsewhere : Pantropical.

Remarks : This species is reported first time from southern India.

Family TROCHOSPHAERIDAE

***Filinia brachiata* (Rousselet, 1901)**

Material examined : 2 examples, R/BKS/TN/309-310, Ambattur lake located 15 kms. South of Chennai, coll. A. Rajan, 19.07.2005; 3 examples, R/BKS/TN/311-313, Vardaraja temple pond, Kanchipuram, 14.01.2007, coll. B.K. Sharma.

Distribution : India : Assam and Meghalaya.

Elsewhere : Cosmopolitan.

Remarks : This species is reported first time from southern India.

***Trochosphaera aequatorialis* Semper, 1872**

Material examined : 3 examples, R/BKS/TN/319-321, pond, Theppakulam, Madurai, 25.05.2006, coll. S. Krishnan; 4 examples, R/BKS/TN/322-325, Velachery lake located 12 kms. South of Chennai, 10.01.2007, coll. B.K. Sharma.

Distribution : India : Assam, West Bengal, Tripura and Bihar.

Elsewhere : Pantropical.

Remarks : This species is reported first time from southern India.

DISCUSSION

Plankton samples examined presently from Tamil Nadu reveal 139 species (149 taxa) of Eurotatoria and, hence, reflect their speciose and diverse taxocoenosis. Besides, our collections exhibit 38 new records from the state and 20 taxa are new records from southern India. The present findings notably raise the faunal diversity of freshwater Rotifera from Tamil Nadu to 177 species (188 taxa) which, in turn, represents the richest biodiversity of the Phylum known till date from any state of India and, is reasonably greater than the highest published report of 148 species from West Bengal (Sharma, 1998b). The overall richness currently documented from Tamil Nadu comprises about 47 % of the Indian Rotifera and it presents a notable increase over 120 species recognized by the authors following a critical review of earlier taxonomic works published from the state. The rotifer fauna of Tamil Nadu as well as species examined by the authors exhibit 53.4% and 55.3% community similarities (*vide* Sorenson's index) respectively with the fauna of Sri Lanka (*vide* Fernando, 1980), thereby, indicating significant divergence in their faunal diversity in spite of the geographical proximity with the island country. On the other hand, the rotifer fauna of Tamil Nadu shows 61.5 % similarity with the fauna of West Bengal (*vide* Sharma, 1998b) and 66.2% similarity with the fauna of Orissa (*vide* Sharma and Sharma, 2005b).

The rotifer fauna of Tamil Nadu is characterized by greater higher diversity. This generalization is endorsed by the fact that out of 67 genera of the Phylum recorded so far from India, 56 genera (83.6%) and all (25) families of Eurotatoria known from this country are represented in Tamil Nadu. The salient features of the rich species, generic and family diversity attach special biodiversity importance to the studied fauna and, reflect greater environmental heterogeneity as well as micro-habitat diversity of the aquatic environs of this state. The stated remarks are also endorsed by 139 species (149 taxa) examined by the authors from Tamil Nadu which, in turn, represent 20 families (80%). On the contrary, the relatively lower generic diversity (38 genera, 67.9%) noticed in our collections in general and lack of the representatives of five families namely Proalidae, Atrochidae, Collothecidae, Adinetidae and Habrotrochidae deserves comment and may be attributed to the planktonic and littoral-periphytonic nature of the presently observed collections.

Tamil Nadu Rotifera include seventeen biogeographically interesting elements (9.8%) belonging to the following categories :

1. Indian endemics: *Pseudoeuchlanis longipedis*, *Asplanchnopus bhimavaramensis* and *Lecane bulla diabolica*.
2. Oriental endemics : *Brachionus donneri*, *Keratella edmondsoni* and *Lecane acanthinula*.
3. Palaeotropical species: *Lecane braumi*, *L. eswari*, *L. lateralis*, *L. simonneae*, *L. unguitata* and *Encentrum longipes*.
4. Nearctic and Palaearctic species: *Brachionus havanaensis*, *Keratella ticinensis*, *Lecane depressa*, *L. elasma* and *Wierzejskiella ricciae*.

Amongst the members of the first category, *Pseudoeuchlanis longipedis* deserves special mention; this endemic Indian genus of the Euchlanidae is represented by only one species described from Andhra Pradesh (Dhanapathi, 1978). Raghunathan and Suresh Kumar (2006) listed its occurrence of *Pseudoeuchlanis* sp. in Tamil Nadu and thus did not indicate any species determination. *Pseudoeuchlanis* was, however, included under the list of invalid Rotifera genera recognized by Segers (2002) while Segers (2007) subsequently considered it to be valid taxon. This rare and interesting euchlanid is not observed in our collections and, hence, its report still requires confirmation but the original description given by Dhanapathi (op cit.) indicates the need for its possible re-examination or re-description. *Asplanchnopus bhimavaramensis*, another interesting Indian endemic, was also described from Andhra Pradesh (Dhanapathi, 1975) and its distributional range is now extended to Tamil Nadu. In addition, *Lecane bulla diabolica* was described by Hauer (1936) from Almati reservoir, Chennai as a form of *L. bulla* and is not known so far elsewhere in India. The last two, nevertheless, are valid taxa but are not noticed in our collections.

Referring to the Oriental endemics, *Brachionus donneri* was described by Brehm (1951) based on the material examined from Almati reservoir, Chennai. Sharma and Sharma (2001, 2005a) considered it to be a Pantropical species while Segers (2007) believed it to be an Oriental element though there is single unconfirmed record of this brachionid from Panama canal waters (? introduction). This species is so far known in India from N. E. region (Assam, Meghalaya, Manipur, Tripura), West Bengal and Tamil Nadu. *Keratella edmondsoni*, another interesting Oriental endemic, was described from Tamil Nadu (Ahlstrom, 1943) as *K. quadrata* var. *edmondsoni* and was subsequently treated as a distinct species by Nayar (1965). It is now recorded from Rajasthan, Tamil Nadu, Northeast India and Northeast Thailand. *Lecane acanthinula*, a possible vicariant of *L. furcata*, is reported in this country from Assam, Tripura, Kerala and Orissa and its distribution is presently extended to Tamil Nadu. The stated Oriental species are, however, observed in our collections and so far exhibit disjunct occurrence in India.

All palaeotropical species, except *Encentrum longipes* are observed by the authors in the samples from Tamil Nadu. Of these, *Lecane braumi*, *L. eswari*, *L. lateralis*, *L. simonneae* merit special global biogeographical interest. The first species, an erstwhile endemic to the floodplains of the river Niger (Segers *et al.*, 1993) is subsequently reported from Indonesia and Papua New Guinea.

This lecanid is characterized by its disjunct distribution in India with reports from Assam, Tripura and Tamil Nadu. *Lecane lateralis*, described by Sharma (1978) from West Bengal as an Indian endemic, is now a widely known palaeotropical species. *L. eswari*, described from Andhra Pradesh (Dhanapathi, 1976), is also recorded from Africa. The present report extends the distributional ranges of *L. eswari* and *L. lateralis* to southern India.

A special mention is desired of certain new taxa described from Tamil Nadu namely *Brachionus caudatus aculeatus*, *Lecane sola*, *Trichocerca flagellata*, *T. tropis* (= *T. voluta*), *T. ruttneri*, *Pseudoembata acutipoda*, *Conochilus madurai* and *C. arboreus*. Amongst these, *P. acutipoda* is termed as “genus and species inquirendae” and, *C. madurai* and *C. arboreus* are ‘species inquirendae’ (refer Segers, 2007). *L. sola* is known from Neotropical and Oriental regions, *T. flagellata* is a tropicopolitan species while the rest are pantropical elements. Besides, *Brachionus durgae*, described from Andhra Pradesh (Dhanapathi, 1971) and recorded from Orissa (Sharma and Sharma, 2005b), is an interesting addition to the rotifer fauna of Tamil Nadu. This is now considered to be a Cosmo(sub)tropical species with reports from African, Neotropical, Oriental and Palaearctic regions.

Thirty-eight species (21.5%) reported from Tamil Nadu namely *Brachionus leydigii*, *Keratella lenzi*, *K. ticinensis*, *Platylabus leloupi*, *Lophocharis oxysternon*, *Mytilina acanthophora*, *Macrochaetus longipes*, *Wolga spinifera*, *Lepadella cristata*, *L. dactyliseta*, *L. minuta*, *L. triba*, *L. quadricarinata*, *Lecane depressa*, *L. elasma*, *L. pusilla*, *L. thalera*, *Eosphora anthadis*, *E. najas*, *Itura aurita*, *Taphrocampa selenura*, *Ascomorpha ecaudis*, *Gastropus hyptopus*, *Trichocerca bicristata*, *T. kostei*, *T. iernis*, *T. tenuior*, *Pleosoma lenticulare*, *Asplanchna herricki*, *Harringia rousseleti*, *Filinia brachiata*, *F. pejleri*, *Testudinella parva*, *Trochosphaera aequatorialis*, *Horaella brehmi*, *Cupelopagis vorax*, *Collotheca ornata* and *Adineta vaga* indicate examples of regional or local distributional importance. The material examined by the authors, however, includes 24 of the listed species.

A number of species reported from Tamil Nadu require confirmation. Among these, *Keratella valga* presents a classical example of erroneous identification in several parts of the world. The validity of its occurrence in Indian waters has been questioned earlier by Sharma (1987), its dubious records from this country in fact belong to *K. tropica*. *K. ticinensis* occurs in Nearctic and Palaearctic; this species is so far known from Kashmir and Tamil Nadu and comments on its distribution in India are also made by Sharma (1991). *Brachionus havanaensis* occurs in Nearctic and Neotropical regions while it is believed (Segers, 2007) to be an introduced species in Oriental region. The authors recommend examination of specimens of *B. havanaensis* and *K. ticinensis* to validate their occurrence. This statement also holds true for *Notholca squamula* (misspelled as *N. scaphula* by Raghunathan and Suresh Kumar, 2006) in general and on the distribution of *Notholca* spp. in India in particular. Raghunathan and Suresh Kumar (loc cit.) indicated occurrence of *Trichocerca tortusa*, *Polyarthra multiappendiculata* and *Cathypna amban*. Referring to the first, it may be indicated

that no such valid species is listed in the global review of genus *Trichocerca* (refer Segers, 2003), the second species is a synonym of *P. vulgaris* (refer Koste, 1978) while the last species is a synonym of *Lecane depressa* (refer Segers, 2007). The authors, however, desire confirmation of earlier records of *Lecane depressa*, *L. elasma* and *L. thalera* from Tamil Nadu.

The cosmopolitan species comprise a major qualitative component (61.0%) of the rotifer fauna of Tamil Nadu. Besides, Pantropical (15.8%) > Tropicopolitan or cosmotropical (11.3%) species are well represented. The observed trends re-affirm our earlier remarks (Sharma and Sharma, 2001, 2005a; Sharma, 2005) and are in conformity with the general composition of the rotifer fauna of India (Sharma 1998b).

Lecanidae (40 species) > Brachionidae (31 species) > Lepadellidae (19 species) > Trichocercidae (12 species) form a dominant fraction (70.1%) of Rotifera examined presently from Tamil Nadu and also an important component of total number species recorded from this state (57.5%). Notommatidae (9 species) = Euchlanidae (9 species) are other notable families (27.8%). Hence, amongst 25 families of Eurotatoria recorded from this state, only six families contribute a significant fraction (120 species, 67.8 %) of the documented species. The qualitative importance of the stated families broadly concurs with the reports of Jose de Paggi (1993, 2001), Sanoamuang (1998), Sharma and Sharma (2001, 2005a, 2008) and Sharma (2005). Interestingly, majority of the listed families, except Brachionidae, are predominantly represented by littoral-periphytic taxa. In addition, Trochosphaeridae (7 species) > Philodinidae (6 species) > Asplanchnidae (5 species) = Synchaetidae (5 species), together, form a valuable sub-dominant component (23 species).

Latitudinal variations in the distribution of Rotifera, directly or indirectly induced by climatological factors, are reported by Green (1972), Pejler (1977), De Ridder (1981) Dumont (1983), Segers (1996, 2008). Segers (2001) stressed the role of thermophiles in the rotifer fauna of Southeast Asia and indicated the qualitative significance of two 'tropic-centered' genera namely *Lecane* and *Brachionus*. The biodiversity importance of these two genera is distinctly observed in the rotifer taxocoenosis of Tamil Nadu. *Lecane* (40 species, 22.6%) is the most speciose genus; its richness represents about 50% of total species so far known from India. In general, the lecanid dominance compares well with the reports of Segers *et al.* (1993, 1998), Sanoamuang (1998), Jose de Paggi (2001), Sharma and Sharma (2001, 2005a, 2008) and Sharma (2005). Among about two dozen *Brachionus* spp. known from the Indian inland waters (Sharma, 1983, 1998a), 17 species are recorded from Tamil Nadu while 16 species are observed in our collections; their richness corresponds with the report of 17 species from West Bengal (Sharma, 1998b) while it is marginally higher than 13 species each recorded from Orissa (Sharma and Sharma, 2001) and Assam (Sharma, 2005).

The qualitative significance of 'tropic-centered' *Lecane* and *Brachionus* as well as wider representation and distribution of several pantropical and cosmotropical species impart a 'tropical character' to the rotifer fauna of Tamil Nadu. This generalization concurs with the composition of

the tropical faunas from different parts of the globe (Green, 1972; Pejler, 1977; Fernando, 1980; Dussart et al. 1984; Segers, 2001; Sharma and Sharma, 2008). In addition, our observations show rich diversity of *Lepadella* (15 species) > *Trichocerca* (12 species). Hence, the mentioned five monogonont genera comprise the bulk of the reported species (92 species, 52.0 %); this salient feature corresponds with the remarks of (Sharma and Sharma, 2005a). Interestingly, the richness of the 'temperate-centered' *Keratella* is noteworthy and requires explanation while *Euchlanis*, *Filinia*, *Ephiphanes* and *Asplanchna*, together include 18 species. In general the most diverse genera, except *Brachionus* and to lesser degree *Keratella* and *Filinia*, include mainly the littoral-periphytonic taxa.

Twenty six species namely *Brachionus durgae*, *B. leydigii*, *B. donneri*, *Keratella edmondsoni*, *K. lenzi*, *Platylabus leloupi*, *Tripleuchlanis plicata*, *Lophocharis oxysternon*, *Mytilina acanthophora*, *Lepadella dactyliseta*, *L. quadricarinata*, *L. minuta*, *L. triptera*, *Lecane braumi*, *L. eswari*, *L. hastata*, *L. lateralis*, *Taphrocampa selenura*, *Pleosoma lenticulare*, *Lacinularia flosculosa*, *Sinantherina spinosa*, *Filinia brachiata*, *Testudinella emarginula*, *T. parva*, *Horaella brehmi* and *Trochosphaera aequatorialis* are rare in our collections examined from Tamil Nadu. On the other hand, *Brachionus angularis*, *B. calyciflorus*, *B. falcatus*, *B. forficula*, *B. diversicornis*, *B. quadridentatus*, *B. rubens*, *Keratella tropica*, *Platylabus patulus*, *Lepadella ovalis*, *L. patella*, *Lecane curvicornis*, *L. leontina*, *L. papuana*, *L. bulla*, *L. closterocerca*, *L. quadridentata*, *Asplanchna brightwelli*, *Polyarthra vulgaris*, *Filinia longiseta*, *F. terminalis* and *Testudinella patina* exhibit common occurrence and a majority of the members of this category often occur in eutrophic waters.

The scattered plankton samples examined by the authors as well as our limitations to the extent of extensive collections do not warrant comments on latitudinal and longitudinal variations of various taxa. Nevertheless, the present observations significantly enrich the status of faunal diversity of Tamil Nadu Rotifera and, provide useful information on biogeographically interesting elements and on status and validity of various species. Our results exhibit rich and diverse spectrum of monogonont rotifers in general and planktonic and semi-planktonic or the littoral-periphytonic elements in particular but still reflect certain lacunae with special reference to benthic, sessile, colonial and bdelloid taxa. The fauna, therefore, has scope for its up-dating based on analysis of specific communities involving special sampling techniques as well as emphasis on collections from different ecosystems. Our conservative estimate, however, expects occurrence over 250 species of Rotifera in Tamil Nadu.

SUMMARY

One hundred seventy-seven species (188 taxa) of Rotifera, belonging to 56 genera and 25 families recorded from Tamil Nadu exhibit the richest species and higher (generic and families) diversity known till date from any state of India. Amongst these, 139 species (149 taxa), spread over 38 genera and 20 families, are observed in our presently examined collections; 38 taxa are new records from the state and 20 taxa are new records from southern India. This study reports

seventeen biogeographically interesting elements including three Indian endemics, three endemic Oriental species, six Palaeotropical species and, five Nearctic and Palearctic elements. Besides, 38 species exhibit examples of regional or local distributional interest. The cosmopolitan species form a major qualitative component (61.0%) while Pantropical > Tropicopolitan or cosmotropical species are well represented. Lecanidae > Brachionidae > Lepadellidae > Trichocercidae > Notommatidae = Euchlanidae comprise a dominant fraction (67.8%) of the rotifer richness. The rotifer fauna of Tamil Nadu depicts 'tropical character' with the greater diversity of 'tropic-centered' genera namely *Lecane* (40 species) > *Brachionus* (17 species) and wider distribution of Pantropical and cosmotropical species. *Lepadella* (15 species) > *Trichocerca* (12 species) are other important genera while the richness of the 'temperate-centered' *Keratella* is noteworthy. Twenty six species are rare in our collections while 25 species show common occurrence and a majority of them often occur in eutrophic waters. The monogononts in general and planktonic and the littoral-periphytonic rotifers in particular are well documented while benthic, sessile, colonial and bdelloid taxa deserve specific analysis.

ACKNOWLEDGEMENTS

The senior author wishes to express gratitude to a number of colleagues and researchers for helping in the collection of plankton samples in various ways and on several occasions; without their generous help, support and kind co-operation this study would have not been possible. The senior author is also thankful to the Head, Department of Zoology, North-Eastern Hill University, Shillong for laboratory facilities. One of the authors (SS) is thankful to the Director, Zoological Survey of India and the Officer-in-charge, Eastern Regional Station, Zoological Survey of India, Shillong.

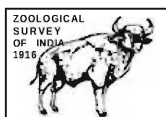
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ECOLOGY, FAUNAL DIVERSITY AND HABITAT MANAGEMENT STRATEGIES OF AMPHIBIANS AND REPTILES OF SUNDERBAN

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INTRODUCTION

Sunderban is one of the largest mangrove ecosystem characterized by a group of islands facing the sea. It starts from mouth of river Hughly in the west to the river Meghna in the east and covers four districts viz., North and South 24 Parganas (Hughly to Raimangal river) of India, Khulna (Raimangal to Madhumati river), Backergunje and Barishal District (Madhumati river to Meghna river) of Bangladesh. It lies between 87° 51'-92° 30' east longitudes and 21° 31'-22° 30' north latitudes. Of the total forest area, we are fortunate to have 4264 sq.km. within the Indian limits. In recent estimate by forest department, it has been stated that 4,264 sq/km of forest persist within Indian territory and the rest 4109 sq/km is in Bangladesh. It is one of the largest wetland ecosystem with riverine areas, encompasses number of rivers, rivulets and creeks. It is a home for variety of fauna and flora and a feeding and breeding site for estuarine crocodile, water monitor and also a landing site for olive ridley turtle.

At present there are about 265 species of amphibians are known from India (Das and Dutta, 2007), and there are about 450 species of reptiles reported from India, though the comprehensive study on amphibians and reptiles from sunderban is very limited. However, Mukherjee (1975) and Chanda (1995) have reported on a few species of amphibians in their study on sunderban biota. Similarly Acharji and Mukherjee (1964); Talukdar (1982) and Saha (1983); Mandal and Nandi (1989); Agarwal and Ghosh (1995) and Sanyal *et al.* (1995) have reported occurrence of reptiles from sunderban. Recently Chowdhury and Vyas (2005) have reported 9 species of turtles, tortoises and terrapins, 9 species of lizards and crocodiles and 23 species of snakes from sunderban. No detailed work has been done on the ecology, faunal diversity of amphibians and reptiles of sunderban and management strategies of its habitat. Hence the present work was undertaken to study the distribution of amphibian and reptilian fauna in various habitat of sunderban and to report the conditions of its habitat and its maintenance.

This work is based on the intensive survey by the author for the last three years from April, 2005 to March, 2008. Totally seven surveys have been undertaken and visited many areas from all

the regions such as in the east Hem Nagar and Kultali; in the west Bakkhali and Bhagwatpur; in the north Hasnabad, Hingal ganj and Nebukhali; in the south Sagar Island, Kakdwip and Patharprotima and in the central Jharkhali and Sandesh khali area of sunderban.

MATERIAL AND METHODS

To obtain first tentative impression of amphibian and reptilian occurrence in the sunderban, distributional data and list of species reported was compiled based on the earlier studies.

Collection Methods : Forest area including mangroves, fresh water ponds, paddy fields, small bushes and old tree trunk, etc in the study area are observed for faunal components. Surveys were undertaken during day time for covering herpetofaunal diversity including heliothermic (basking) reptiles. In the evenings nocturnal species such as frogs, toads and snakes were also covered by using torch.

The amphibians and reptiles sampled by searching through their suitable hiding places in deeply shaded forest, inside the soil nearby ponds. The call of frogs were also taken as guiding tools for their easy collection. Some species were identified based on the physical features (external features/body scales) with the help of field guide and reference books in the field and noted in the field note book. Boats were hired where ever necessary and assistance of fisherman was also rendered for the collection of reptilian species. Generally lizards, snakes, frogs and toads were collected by using long forceps.

The habit and habitat was recorded based on the field observations.

SYSTEMATIC ACCOUNT

Class AMPHIBIA

Order ANURA FISCHER

Family BUFONIDAE

Genus *Duttaphrynus* Frost *et al.*, 2006

1. *Duttaphrynus melanostictus* (Schneider, 1799)

Common Indian Toad

Material examined : 1ex., Kalithala, xi.11.2006, Coll. VAR, KN-1373; 1ex., Kakdwip, xxvi.10.2007, Coll. VAR, KN-1384; 2exs., Patharprotima, ii.11.2007, Coll. VAR, KN-1385.

Habit and Habitat : It is nocturnal in habit, occur at damp places, under logs, etc. It hides under bark of the tree trunk and its holes, under stones, etc. during day time.

Food habit : It feeds mainly on insects. It has a sticky extensive tongue and the prey is crammed into mouth, small particles of food are swept into mouth by fanning action of the front feet.

Breeding : It breeds mainly in monsoon, but under favorable conditions it may breeds throughout the year. There is a considerable competition among males for getting females. The females lays the eggs in running water, pool and tanks in the form of a strings which is composed of gelatinous material to protect the eggs from washed away water current. The development is very short.

Distribution : India; They have been recorded in Meghalaya, Arunachal Pradesh, Sikkim.

Elsewhere : Burma; Sri Lanka; China; Malaysia; Indonesia; Philippines.

Status : Least concern.

Family MICROHYLIDAE

Subfamily MICROHYLINAE

Genus *Microhyla* Tschudi, 1838

2. *Microhyla ornata* (Dumeril and Bibron, 1841)

Ornate Microhylid

Material examined : 4exs., xxvii.10.2007, Paschim Gangadharpur, Coll. VAR, KN-1389.

Habit and Habitat : It occurs in forest vegetation and grassy, water pools and dry litter.

Food habit : It is insectivorous and feeds mainly on ants and insects.

Breeding : It breeds with the onset of monsoon specially from May to August. During monsoon the male and female sits in pairs close to water and the female lays the eggs which are attached to submerged grasses in shallow water.

Distribution : They have been recorded all over India.

Elsewhere : Myanmar; Sri Lanka; Southern China; Indo-China.

Status : Least concern.

Family DICROGLOSSIDAE

Subfamily DICROGLOSSINAE

Genus *Euphlyctis* Fitzinger, 1843

3. *Euphlyctis cyanophlyctis* (Schneider, 1799)

Indian skipper frog

Material examined : 4exs., v.11.2007, Sagar Island, Coll. VAR, KN-1388.

Habit and Habitat : It inhabits in all biotopes and in all seasons of the year. It is aquatic in nature and active during day and night. It has an interesting habit of skipping on the water surface.

Food habit : It is a voracious feeder and feeds mainly on insects, tadpoles and insect larvae.

Breeding : It breeds during monsoon. Tadpoles were found in the month of July.

Distribution : They have been recorded all over India.

Elsewhere : Pakistan; Afghanistan; South Arabia; Sri Lanka.

Status : Least concern.

4. *Euphlyctis hexadactylus* (Lesson, 1834)

Indian green frog

Material examined : 6exs., xxi.7.2006, Sandeshkhali, Coll. VAR, KN-1370.

Habit and Habitat : It is aquatic in nature and found abundantly along bank of river and also in tanks. The adult frog occur along the green weeds and it looks bright green and resembles green vegetation, so that we cannot recognize its presence easily, only when it starts crocking we can come to know its presence along grassy green vegetation in ponds.

Food habit : The adult are carnivorous and feeds on worms, fishes, etc.

Breeding : With the onset of monsoon the male and female are appears and swims together in the water, the males starts croaking and attracting the female by making in-cessant calling. After reaching the female the male and female pairs and swims in the water and female lays the eggs in the water. The eggs have seen attached to submerged vegetation in the form of string.

Distribution : India : They have been recorded in West Bengal; Tripura; Maharashtra; Tamil Nadu; Kerala.

Elsewhere : Sri Lanka.

Status : Least concern.

Genus *Fejervarya* Bolkey, 1915

5. *Fejervarya limnocharis* (Gravenhorst, 1829)

Paddy Field frog

Material examined : 2exs., x.11.2006, Hemnagar, Coll. VAR, KN-1374; 3exs., xx.07.2006, Bangatush khali, Coll. VAR, KN-1372; 1ex., xix.04.2006, Hingaljanj, Coll. VAR, KN- 1390.

Habit and Habitat : It is found in the vicinity of tanks and water streams and also in paddy field throughout the year. It does not float on the water surface but rests on the surface of water. During dry season they found in damp places or under logs.

Food habit : It feeds on insects and worms.

Breeding : Juveniles were found in the month of February.

Distribution : They have been recorded all over India.

Elsewhere : Sri Lanka; China; Malaysia; Indonesia; Philippines.

Status : Least concern.

Genus *Hoplobatrachus* Peters, 1863

6. *Hoplobatrachus tigerinus* (Daudin, 1803)

Indian Bull frog

Material examined : 2exs., xxiii.06.2005, Jharkhali, Coll. VAR, KN-1368; 4exs., xxi.07.2006, Sandeshkhali, Coll. VAR, KN-1371.

Habit and Habitat : It is aquatic and occurring in wells, tanks and ponds throughout the year. During hibernation and aestivation it is found deep in the soil. With the onset of monsoon plenty of were seen in the field.

Food habit : It feeds mainly on insects, fishes and its liver, etc.

Breeding : It breeds during rainy season. The male has an vocal sac which is bright cobalt blue color. With the onset of monsoon rain the male frog starts to croak loudly and incessantly. Male

and females were swim together in the water. After breeding male lose its yellow color. Eggs are laid in small puddles, the eggs are surrounded by a transparent jelly substance. After hatching the tadpoles are swept into pools.

Distribution : They have been recorded all over India.

Elsewhere : Nepal; Burma; China; Indonesia.

Status : Least concern.

Class REPTILIA

Order CROCODYLIA

Family CROCODILIDAE

Genus ***Crocodylus*** Gronovius, 1763

1. ***Crocodylus porosus*** (Schneider, 1801)

Estuarine crocodile

Material examined : Observed in the field.

Habit and Habitat : It is a sluggish and lethargic creature typically associated with brackish water, such as coastal mangrove swamp forests, but also visits fresh water river. It is semi-aquatic and enters sea to long journeys and inhabits estuaries. It lives in saline water but drinks fresh water.

Food habit : It is an opportunistic feeder and feed during both day and night and ebb and flood tide. It is a shallow water or edge feeder. Juvenile and sub adults feeds on crustacean, insects and small fish, whereas adults feeds on sharks, monkeys, even men and larger ones are cannibalistic.

Breeding : The male attains the sexual maturity at the age of 16 years and female at 10 years. The female makes mound nest in the wet season and lays 25-120 eggs and the incubation period is between 80-100 days and the parental care takes place by females.

Locality : Bakkhali and Bhagwatpur area of sunderban.

Distribution : India; They have been recorded in East coast of India; Andaman and Nicobar Island.

Elsewhere : Sri Lanka; Bangladesh; Philippines; Malaysia; Indonesia; Australia.

Status : Protected species under Schedule I, Wild life Protection Act ,1972. The total populations in India may be around 170-330. Several breeding centres across the country at Andhra Pradesh, Tamil Nadu and West Bengal are successfully rearing the species. The species breeds readily in captivity.

Order CHELONIA

Family CHELONIDAE

Genus ***Lepidochelys*** Fitzinger,1843

2. ***Lepidochelys olivacea*** (Eschscholtz, 1829)

Olive ridley turtle

Material examined : Observed in the field.

Habit and Habitat : It is a marine turtle.

Food habit : It feeds on crustacean such as crabs, shrimps; molluscs, jellyfish, tunicates, small in-vertebrate, fishes and their eggs, large planktons and marine algae. It swims over long distance and float calmly over deep sea water, waiting for certain crustaceans which emerge to the surface of water only during night.

Breeding : It forages at great depth in tropical neritic water, nest takes place at night, egg laying occurs for 15-20 minutes in a shallow nest cavity and refill and cover the nest after egg laying. The females rough up the surface of nest site by compact the soil by thumping with its shell. Incubation occurs for 49 to 62 days and females nest 2 to 3 times in a season. The females migrate to the nest after two years.

Locality : Bhagwatpur and Bakkhali area of sunderban.

Distribution : India : They have been recorded in West Bengal; Orissa; Andaman and Nicobar Islands.

Elsewhere : Pacific; Indian; South Atlantic oceans.

Status : Protected species under Schedule I, Wildlife (Protection) Act, 1972. New Delhi CITES convention prohibited its collection and Since July, 1981. Appendix I, CITES.

Family EMYDIDAE

Genus *Batagur* Gray, 1855

3. *Batagur baska* (Gray, 1831)

River Terrapin

Material examined : Observed in the field.

Habit and Habitat : It is found at fresh, brackish or salt water and also in fresh water lakes, canals and water bodies and shallow muddy tidal region at the wide river mouth lined with mangrove.

Food habit : It is an omnivorous and prefers vegetation diet consists stem, leaves and fruits of river side plants. It also feeds on mollusca, crustaceans and fishes.

Breeding : The mating occurs during September and November and males assumes bright *breeding* color during mating. It nests in colony on the sandy banks of with slopes and river islands. Nesting females are site specific and there is a definite period for egg deposition. The females dig the pit for nest and creating deep egg chamber and deposits the eggs in three clutches and the whole egg laying may occur for 15 to 20 days. It covers the nesting spot and surrounding area with sand and females dig a false nest to confuse the predator.

Locality : Jinga Khali area of sunderban.

Distribution : India : They have been recorded in West Bengal.

Elsewhere : Bangladesh; Burma; Thailand; Vietnam; Malay Peninsula; Sumatra.

Status : Protected species under:-Scheduel I, Wildlife (Protection) Act, 1972. The species is endangered all along the range and is protected by legislation throughout its range. Many hatcheries have been established for incubation of its eggs at Malaysia. It Appendix I, CITES.

Order SQUAMATA

Suborder LACERTILIA

Family GEKKONIDAE

Genus **Gekko**, Linnaeus, 1758

4. **Gekko gekko** (Linnaeus)

House gecko

Material examined : 4exs., xx.04.2006, Hasnabad, Coll. VAR, KN-1391; 5exs., xxx.10.2007, Sagar Island, Coll. VAR, KN-1392.

Habit and Habitat : It inhabits in houses, holes in walls, trees, on the ground, etc.

Food habit : It is mainly insectivorous and feeds on moths, spiders, beetles, cockroaches, flies, etc. It has a thick tongue and food subjected to chewing to enable it to swallow.

Breeding : It is oviparous and the female lays two eggs with shells as hard and brittle and produce a pair of eggs on the time adhesive to walls. I have found young and eggs on the coconut palm . Each are round and white eggs and measured about 3/8 inches in diameter.

Distribution : They have been recorded all over India.

Status : Least concern.

Genus **Hemidactylus**, Oken

5. **Hemidactylus brooki** (Gray, 1845)

Spotted Indian House gecko

Material examined : Observed in the field.

Habit and Habitat : It is terrestrial and inhabits in open forests, bark of tree trunks and old deserted buildings.

Food habit : It is insectivorous and feeds on insects, spiders, etc.

Breeding : It is viviparous. It breeds during summer and the female lays two small spherical eggs in a single clutch which hatch out in subsequent days.

Locality : Many localities throughout Sunderban such as Sagar Island and Sandesh Khali area.

Distribution : India : They have been recorded all over India.

Elsewhere : Sri Lanka.

Status : Least concern.

Family AGAMIDAE

Genus **Calotes**, Merrem

6. **Calotes versicolor** (Daudin, 1802)

Indian Garden lizard

Material examined : Observed in the field.

Habit and Habitat : It is an arboreal lizard , living in bushes, shrubs and also in plain area.

Food habit : It is insectivorous and particularly feeds on ants, spiders, centipedes, etc.

Breeding : It breeds during summer and extends upto rainy season. It may lays 6-25 eggs in a clutches in the hole in the soft soil.

Locality : Gazi khali area of sunderban.

Distribution : India : They have been recorded all over India.

Elsewhere : Sumatra to South China; Sri Lanka; Pakistan; Afghanistan.

Status : Least concern.

Genus *Sitana*, Cuvier

7. *Sitana ponticeriana* (Cuvier, 1829)

Fan Throated lizard

Material examined : Observed in the field.

Habit and Habitat : It is a fast runner, it occurs in shrub vegetation and sandy area.

Food habit : It is insectivorous and feeds on ants and other insects.

Breeding : It breeds during summer. The female lays around 6-14 eggs in a clutch which buried in the soil.

Locality : Sandesh khali and Sagar Island areas of sunderban.

Distribution : India : They have been recorded all over India.

Elsewhere : Sri Lanka.

Status : Least concern.

Family Chamaeleonidae

Genus *Chamaeleon* Laurenti, 1768

8. *Chamaeleo zeylanicus* (Laurenti, 1768)

Indian Chaemaeleon

Materials examined : Observed in the field.

Habit and Habitat : It is an arboreal lizard.

Food habit : It is an insectivorous and feeds on insects, spiders, etc.

Breeding : These are oviparous, females eggs are laid in, deposited in the ground , rocks, it may breed during May.

Locality : Many localities of sunderban such as Sagar Island, Gazikhali, etc.

Distribution : They have been recorded all over India.

Elsewhere : Sri Lanka; Pakistan.

Status : Least concern.

Family SCINCIDAE

Genus *Mabuya*, Fitzinger

9. *Mabuya carinata* (Schneider, 1801)

Common Skink

Material examined : Observed in the field.

Habit and Habitat : It is a terrestrial, diurnal lizard and lives under bushy area.

Food habit : It is insectivorous.

Breeding : It is oviparous and laying around 6-10 eggs.

Locality: Pakhiralaya area of sunderban.

Distribution : India : They have been recorded in Peninsular India; Assam; West Bengal.

Elsewhere : Sri Lanka; Nepal.

Status : Least concern.

Family VARANIDAE

Genus *Varanus* Merrem, 1820

10. *Varanus salvator* (Daudin, 1802)

Water monitor

Material examined : Observed in the field.

Habit and Habitat : It is an aquatic, inhabit wet, marshy and humid forests, banks of rivers and also estuarine forests.

Food habit : It is omnivorous and swims for long distance in sea in search of food and feeds on bird eggs and fishes.

Breeding : It breeds from June to August. It lays nearly 15 -30 eggs in holes on the river banks or on the trees besides water.

Locality : Sajne khali area of sunderban.

Distribution : India : They have been recorded all over India.

Elsewhere : Sri Lanka; Bangladesh; Northern Burma; Southeast Asia; Northern Australia.

Status : Protected species under :-Schedule I, Wild life (Protection) Act, 1972 and is at risk throughout its range.

Family TYPHLOPIDAE

Genus *Typhlops* Oppel, 1811

11. *Typhlops porrectus* (Stoliczka, 1871)

Slender Blind snake

Materials examined : Observed in the field.

Habit and Habitat : It is a nocturnal worm snake, hiding under stones, wooden logs, etc.

Food habit : It feeds on worms and fishes.

Breeding : It is not known.

Locality : Rangabelia area of sunderban.

Distribution : They have been recorded all over India.

Status : Least concern.

Family COLUBRIDAE

Genus *Ptyas* Fitzinger, 1843

12. *Ptyas mucosus* (Linnaeus, 1758)

Rat snake

Material examined : 2exs., x.11.2006, Hemnagar, Coll. VAR, KN-1379.

Habit and Habitat : It is an aquatic and diurnal snake. Occur at varied habitat like plain, agriculture fields, grass lands, trees and hollows under wooden logs, crevices of rocks, etc.

Food habit : It feeds on small mammals, birds, reptiles, eggs of birds and amphibians.

Breeding : The *breeding* season starts from April which extends up to September.

Distribution : They have been Recorded in Meghalaya; Assam; Sikkim; West Bengal.

Elsewhere : Throughout south and southeastern Asia.

Status : Protected species under :-Appendix II, CITES.

Genus *Elaphe* Fitzinger, 1833

13. *Elaphe helena* (Daudin, 1803)

Trinket snake

Material examined : Observed in the field.

Habit and Habitat : It is a nocturnal in habit and inhabits crevices in rocks, hollows in trees, dense bushes, etc.

Food habit : It feeds on small mammals, birds, lizards and amphibians.

Breeding : The female lays around 6-8 eggs and the hatchlings are very much similar to parents.

Locality : It was observed at Paschim Gangadharpur and Rangabelia area of sunderban.

Distribution : They have been recorded in Gujarat; Himalayas; Assam; Nagaland.

Elsewhere : Sri Lanka; Pakistan.

Status : Least concern.

Genus *Oligodon* Boie, 1827

14. *Oligodon arnesis* (Shaw, 1802)

Common Kukri snake

Material examined : Observed in the field.

Habit and Habitat : It is a diurnal snake and inhabits masonry work building, rocky area and also in plain area.

Food habit : It feeds on insects, spiders, small reptiles and their eggs, amphibians, birds and their eggs, small rodents or mice.

Breeding : It is oviparous.

Locality : Ranga belia area of sunderban.

Distribution : They have been recorded in Gujarat; Penninsular India; Western Himalaya; West Bengal.

Elsewhere : Pakistan; Nepal; Bangladesh; Sri Lanka.

Status : Least Concern.

Genus *Lycodon* Boie, 1826

15. *Lycodon aulicus* (Linnaeus, 1758)

Common Wolf snake

Material examined : 2exs., v.06.2007, Canning, Coll. VAR, KN-1382.

Habit and Habitat : It is nocturnal and good climber. It is commonly found in and around the human habitation.

Food habit : It feeds on small lizards, frogs and also mice.

Breeding : It is oviparous in nature and during *breeding* season it may lays 3 to 11 eggs in a single clutch.

Distribution : They have been recorded all over India.

Elsewhere : Pakistan; Nepal; Sri Lanka; Bangladesh; Myanmar.

Status : Least concern.

Genus *Amphiesma* Dumeril & Bibron, 1854

16. *Amphiesma stolatum* (Linnaeus, 1758)

Striped snake

Material examined : 1ex., ix.11.2006, Hemnagar, Coll. VAR, KN-1378; 1ex., xxx.10.2007, Namkhana, Coll. VAR, KN-1386.

Habit and Habitat : It is found in moist grassy areas, under stones, wooden logs, under leaves of tree and also in gardens.

Food habit : It feeds on frogs, toads, lizards and also small mammals.

Breeding : During *breeding* season i.e. in May it may lays about 10 eggs in a single clutch and it incubate the eggs for about 20 days.

Distribution : They have been recorded all over India.

Elsewhere : Pakistan; Nepal; Bhutan; Bangladesh; Sri Lanka.

Status : Least concern.

Genus *Xenochrophis* Gunther, 1864

17. *Xenochrophis piscator* (Schneider, 1799)

Checkered Keelback

Material examined : 1 ex., x.11.2007, Hemnagar, Coll. VAR, KN-1375.

Habit and Habitat : It inhabits marshy areas, pools of water, ditches, canals and shallow edge of rivers contains vegetation.

Food habit : It feeds mainly on small fishes and frogs.

Breeding : Courtship and mating occurs in around September and October. It lays eggs in late November to the end of May. Egg clutches are varies from 80 to 90 eggs. The incubation period ranges from 35 to 55 days.

Distribution : They have been recorded all over India.

Elsewhere : Rest of South Asia.

Status : Protected species under :-Appendix III, CITES.

Genus *Atretium* Cope, 1861

18. *Atretium schistosum* (Daudin, 1803)

Olivaceous Keelback

Material examined : Observed in the field.

Habit and Habitat : It occurs in the vegetation near fresh water.

Food habit : It feeds mainly on fishes and also frogs.

Breeding : It is oviparous in nature and during *breeding* period it lays 12 to 30 eggs at a time.

Locality : Rangabelia and its surrounding of area of sunderban.

Distribution : They have been recorded in Anaimalais; Wynaad; Mysore; Uttar Pradesh; Orissa.

Elsewhere : Sri Lanka; Bangladeh; Nepal.

Status : Least concern.

Genus *Ahaetulla* Link, 1807

19. *Ahaetulla nasuta* (Lacepede, 1789)

Green Whip snake

Materials examined : Observed in the field.

Habit and Habitat : It is a diurnal, arboreal snake and inhabits dense cluster and branches of vegetation.

Food habit : It feeds mainly on lizards, birds, amphibians and also small mammals.

Breeding : It is viviparous and give birth to 3-22 young ones at a time and breeds during March and extends up to December.

Locality : Gosaba and Rangabelia area of sunderban.

Distribution : They have been recorded in Gujarat; Penninsular India; West Bengal.

Status : Endangered (Rare).

Genus *Enhydris* Sonn & Latr, 1802

20. *Enhydris enhydris* (Schneider, 1799)

Smooth Water snake

Material examined : 1ex., xx.09.2005, Bakkhali, Coll. VAR, KN-1369; 1ex., xii.11.2006, Hemnagar, Coll. VAR, KN-1376.

Habit and Habitat : It is a gentle snake, inhabits ponds, irrigation fields, water bodies and also in slow running canals.

Food habit : It feeds on fishes, lizards and also frogs.

Breeding : It is viviparous in nature and produces 6 to 18 young ones at a time.

Distribution : They have been recorded in Madhya Pradesh; Uttar Pradesh; Andhra Pradesh; Bihar; Orisaa; West Bengal; Assam.

Elsewhere : Bangladesh; Nepal; Myanamar.

Status : Least concern.

Genus *Cerberus* Cuvier, 1829

21. *Cerberus rhynchops* (Schneider, 1799)

Dog-faced water snake

Material examined : 2exs., viii.11.2006, Hemnagar, Coll. VAR, KN-1377.

Habit and Habitat : It is nocturnal in habit and inhabiting the holes and crevices in the estuaries of tidal rivers. It is a good swimmer.

Food habit : It feeds on fishes, frogs and also toads.

Breeding : It is viviparous and gives birth to 6 to 28 young ones at a time.

Distribution : They have been recorded in Gujarat; Coastal and tidal rivers of India from Bomaby to Cochin-China; Andaman and Nicobar Islands.

Elsewhere : Pakistan; Bangladesh; Sri Lanka upto Australia.

Status : Common.

Genus *Bungarus* Daudin, 1803

22. *Bungarus caeruleus* (Schneider, 1801)

Common Indian krait

Material examined : Observed in the field.

Habit and Habitat : It is nocturnal in habit and inhabits grassland, rocky area, marshy and also in gardens.

Food habit : It feeds on small mammals, frogs, toads, lizards and also fishes.

Breeding : It breeds during April to July. During *breeding* period it lays about 6 to 10 eggs in the holes of ground.

Locality : Kakdwip and its surrounding area of sunderban.

Distribution : They hve been recorded in Gujarat; West Bengal; Peninsular India; Rajasthan; Punjab; Haryana; Uttar Pradesh; Madhya Pradesh; Orissa; Maharashtra; Andhra Pradesh; Karnataka; Tamil Nadu; Kerala.

Elsewhere : Pakistan; Nepal; Bangladesh; Sri Lanka.

Status : Least Concern.

Genus *Naja* Laurenti, 1768

23. *Naja naja Kaouthia* (Lesson, 1831)

Monoocelate cobra

Material examined : 1ex., Kakdwip, xxvi.10.2007, Coll. VAR, KN-1383.

Habit and Habitat : It is a diurnal snake and inhabits in agriculture field, grassy vegetation and in rodent caves.

Food habit : It feeds on frogs, lizards, rodents, etc.

Breeding : It breeds during April to July. During *breeding* period it lays around 9 to 45 eggs and the incubation period lasts for about 62 to 90 days.

Distribution : They have been recorded in Assam; West Bengal; Bihar; Eastern Uttar Pradesh; Eastern Himalayas.

Elsewhere : Bangladesh; Nepal; China; Most of the South- east Asia; Peninsular Malaysia.

Status : Least Concern.

Genus *Enhydrina* Gray, 1849

24. *Enhydrina schistosum* (Daudin, 1803)

Beaked sea snake

Materials examined : Observed in the field.

Habit and Habitat : It is a marine poisonous snake inhabits shallow coastal water.

Food habit : The main food of the species are fishes, crustaceans and prawns.

Breeding : It is ovo-viviparous and gives birth to 4-9 juveniles.

Locality : Sagar Island area of sunderban.

Distribution : They have been recorded in Gujarat; Coastal water of Goa; Tamil Nadu; Orissa; West Bengal.

Elsewhere : Pakistan; Bangladesh; Sri Lanka; Indo-pacific water (Thailand, Malaysia and Singapore).

Status : Least concern.

Genus ***Hydrophis*** Latreille, 1802

25. ***Hydrophis caerulescens*** (Shaw , 1802)

Many Toothed sea snake

Material examined : Observed in the field.

Habit and Habitat : It inhabits swampy area and also in mangrove ecosystem.

Food habit : It feeds on fishes and crustaceans.

Breeding : It is not known.

Locality : Hem nagar and Dulduli area of sunderban.

Distribution : They have been recorded in Coasts of Goa; Maharashtra; Karnataka; Tamil Nadu; West Bengal; Gujarat.

Elsewhere : Pakistan; Bangladesh; China; Myanmar; Malaysia; Thailand to Australia.

Status : Least concern.

26. ***Hydrophis nigrocinctus*** (Daudin, 1803)

Banded sea snake

Materials examined : Observed in the field.

Habit and Habitat : It inhabits in the brackish water.

Food habit : It feeds on fishes, frogs, etc.

Breeding : It is not known.

Locality : Observed in the field at Hemanagar area of sunderban.

Distribution : They have been recorded in Bay of Bengal (Sunderban).

Elsewhere : Japan; Tasmania.

Status : Rare.

HABITAT MANAGEMENT

There is an ongoing global biodiversity crisis due to unprecedented loss of natural habitat (ecosystem). In order to conserve and enhance the animal population, it is essential to monitor its natural habitat. Habitat loss is one of the reason that many species were disappeared in the wild, some were facing extinction and some are in danger in near future. The most recent publication of IUCN red list of threatened species has reported that 39% of listed species are threatened with extinction (IUCN, 2007). The major threat for the loss of natural habitat is the human modification of nature/interference and his settlements in the nearby forests by removing the forests/ rivers, etc. This led to the loss of habitat of many species and it ultimately leads to complete disappearance/ elimination of many species in the wild. Therefore, there is an urgent need to develop the strategies to protect natural habitat.

Despite ecological and evolutionary roles played by the amphibians and reptiles, the studies on strategies of habitat of these groups have been ignored or given little consideration. Hence in the present study an attempt was made to know the present conditions of different habitat of these important groups and necessary measures to improve its habitat, so that we can protect and enhance its population.

(i) **Present conditions of different habitats :** The forceful human settlements by removing mangrove vegetation and virgin forest land has caused the loss or complete destruction of natural habitat of many evolutionarily important fauna of amphibian and reptiles. The construction of roads, dams, etc, by removing the natural habitat hinders the movement of animals in the nature and number of animals have been dying due to road accident. The clearance of original habitat for agriculture purpose has led to the depletion of many species in the nature. Discharge of domestic waste, pesticides and fertilizers to the river have affected on the larval development of amphibians. The loss of terrestrial and aquatic habitat have resulted in the reduction of primary productivity and primitive communities, this led to decreased availability of food and declined in the number of animal communities. The affect on primary productivity imbalances the whole ecosystem and ultimately the whole population will be under danger. At present both aquatic and terrestrial habitat of many species of amphibians and reptiles in sunderban are under deteriorated condition due to continuous human interference for every day needs. Therefore there is an urgent need to protect these population in sunderban.

(ii) **Important measures to protect the habitat:** In sunderban already the population of *Lepidochelys olivacea*, *Batagur baska* have declined in their number due to habitat loss. The *Crocodylus porosus* and Monitor lizard are very rare to see in sunderban. Many species of frogs and snakes have declined in their number due to loss of habitat. The important measures to protect these species are :

(a) *Proper maintenance of fresh water ponds all along/ nearby river bank :* The fresh water ponds of aquatic frogs, snakes, etc. should have proper length, width and depth, so that the frogs and snakes moves/swims throughout the pond and bred easily. The proper depth will helps in sitting of insects and for its multiplication and also for fishes to breed and multiply. This will serve as food for frogs and in turn frogs will serve as food for snakes. In the ponds proper water level has to be maintained throughout the year depends upon the season and time of the year. The decreased water level leads to moves out of many species. Special attention has to be given to control temperature, nutrients, oxygen, turbidity, salinity, etc. in the ponds. Growing of dense masses of algae, submerged angiosperm, control of plankton, growing of green grasses will helps in sitting of insects and also its multiplication. As amphibians and reptiles are ectothermic, the body temperature of these animals may vary with environmental conditions and the rise in temperature may affecting its metabolic activity. Thermal conditions in natural water played major role in ecology of amphibians and reptiles. Temperature serves as a cue for variety of life process and distribution of these

species. Consequently altered temperature may have serious consequences for aquatic species. Development of natural vegetation in the ponds will minimize alternation in temperature. Salinity is fatal to amphibians. The eggs and larvae are killed even by one percent of salinity, therefore care has to be taken to prevent mixing of saline water in the ponds and regular checking of saline concentration in the water has to be undertaken.

(b) *Protection of terrestrial habitat from grazing* : Particularly for terrestrial toads, snakes, lizards, etc. protection of terrestrial habitat from cattle grazing will preserve its natural habitat. For example the terrestrial toads prefers moisture land and bushy vegetation where many number of insects can settle and it will serve as a food for frogs. In turn, the bushes are serves as shelter ground for many land snakes where it can catch frogs, toads, etc. Therefore, protection of natural habitat from grazing will protect the terrestrial species and conserve its population.

(c) *Shifting of human settlement nearby forests/river* : Human settlements nearby forest/river have destroyed the natural habitat of many species in the wild and caused disappearance of many species in the environment. Therefore shifting human settlement nearby forest/river will protect the natural habitat of many species in the wild and its population.

DISCUSSION

The present study deals with 32 species of amphibians and reptiles for studying the habitat, food habit, distribution and present conditions of different habitat in sunderban. The available literature from the previous works has revealed that the work was limited to the occurrence of different species in the area. In the present study it was observed that the amphibians and reptiles have been occur in a wide variety of habitat such as terrestrial, aquatic, arboreal, burrowing etc.

The majority of amphibians live only on land or in fresh water and usually they were confined to stagnant and slowly running water and the fauna represented by the terrestrial *Duttaphrynus melanostictus*. The anurans are almost entirely aquatic in their habitat such as *Hoplobatrachus tigerinus* which enters water chiefly during *breeding*. The reptilian fauna in the estuaries are represented by the number of sea snakes, turtles, crocodiles. The sea snakes namely *Hydrophis nigrocinctus* quite common and highly poisonous. The dog faced water snake (*Cerberus rhynchops*) is very common along the estuarine rivers of sunderban. Turtles namely *Batagur baska*, olive ridley turtle, estuarine crocodile *Crocodylus porosus* were found in the river. Biswas (1983) has reported on the food and feeding habit of estuarine crocodile where it also invades muddy areas in the mangrove ecosystem.

Most of the mangrove amphibians and reptiles do not show any anatomical modifications to meet the environmental conditions. However, they show some behavioral adaptations such as burrowing is the common behavior to hidden from the predators and enters the period of hibernation and aestivation during un-favorable conditions.

SUMMARY

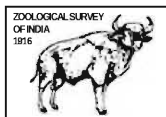
In the present study a total of 32 species of which 6 species of amphibians belonging to 1 order 3 families, 3 genera and 26 species of reptiles belonging to 3 orders, 10 families and 3 genera respectively are reported. As per the study frogs, toads and snakes are quite plentiful in sundernban, whereas crocodiles, turtles and monitor lizard are less in number. This paper based on the collections and observations made by the author for a brief period of three years survey in the area. In the present study the author come across rare and endangered species in the sunderban namely, dog-faced water snake *Cerebrus rhynchops*, water monitor, *Varanus salvator* estuarine crocodile, *Crocodylus porosus*, and turtles *Lepidochelys olivacea* and *Batagur baska*.

ACKNOWLEDGEMENTS

The author is grateful to the Director, Zoological Survey of India, Kolkata for sanction of the project and providing facilities to undertake the research. Thanks are also due to Dr. N.C. Nandi, Scientist 'E', Zoological Survey of India for his suggestions for finalizing the manuscript. Last but not least to Dr. Satyanarayana, Assistant Zoologist, Zoological Survey of India for helping in grabbing the photographs with the computer.

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Rec. zool. Surv. India : **109**(Part-3) : 79-84, 2009

**A COMPARATIVE REVIEW OF THREE CLOSELY RELATED
CALICNEMIA SPECIES – *C. PULVERULANS* SELYS, *C. IMITANS*
LIEFTINCK AND *C. SUDHAAE* MITRA (ODONATA : ZYGOPTERA :
PLATYCNEMIDIDAE)**

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INTRODUCTION

The Genus *Calicnemia* Strand 1926, comprising ten Indian species occurs from Indo-China to Indo-Burma region. Among these, three species, *Calicnemia pulverulans* Selys, *Calicnemia imitans* Lieftinck and *Calicnemia sudhaae* Mitra occurring in Eastern India-Myanmar region are very closely related in morphological characters. According to Lieftinck (1984) *Calicnemia* radiated from the Himalayan region. *C. pulverulans* was first described by Selys (1886) from Sikkim and North Bengal. Kumar and Prasad (1981) and Prasad (2002) have also reported it from Uttar Pradesh (now Uttarakhand). Later on Lieftinck (1948) described *C. imitans* from Burma (Myanmar), but recognized as closely allied to *C. pulverulans* with some dissimilarities. *C. imitans* was recorded later from Meghalaya (Lahiri, 1987). Another species of genus *Calicnemia* has been described by Mitra (1994) as *C. sudhaae* from Mizoram and the description is provided in Mitra (2002). These three species of genus *Calicnemia* are similar in various morphological characters though they are still recognized as different species (Prasad and Varshney, 1995; Tsuda, 2000). In this present study, attempt has been made to compare the morphological characters of these closely related species, finding their degree of similarities and variations for determination of their actual status.

MATERIAL EXAMINED

***Calicnemia sudhaae* Mitra**

Holotype : Mizoram : Aizwal : Teirei, 1G, 24.x.1991, Coll. J.K. Jonathan (ZSI Reg. No. 4133/H13); *Allotype* : Mizoram : Aizwal : Teirei, 1E, 24.x.1991, Coll. J.K. Jonathan (ZSI Reg. No. 4134/H13); *Paratypes* : Mizoram : Aizwal : Teirei, 1G, 24.x.1991, Coll. J.K. Jonathan (ZSI Reg. No. 4135/H13); Aizwal: Lunglei Road (15 km from Aizwal), 2G, 26.x.1991, Coll. J.K. Jonathan (ZSI Reg. No.4136/H13; 4137/H13); Aizwal : Dampa Wildlife Sanctuary, 1G, 24.x.1991, Coll. J.K. Jonathan (ZSI Reg. No. 4138/H13).

***Calicnemia pulverulans* Selys**

Sikkim : Lingjok, 1G, 20.v.1962, Coll. G. Ramakrishna (ZSI Reg. No. 3946/H13); Uttarakhand (Western Himalaya) : Chamoli : Debal, 1G, 1E, 03.ix.1972, Coll. T.K. Chakraborty (ZSI Reg. No. 4752/H13; 4753/H13).

***Calicnemia imitans* Lieftinck**

No specimen could be obtained for study. Hence the morphological characters and measurements are included here on the basis of the description provided by Lieftinck (1948).

FINDINGS

The comparative study has been made and the morphological characters are provided in Table-1.

Table-1. Comparative morphological characters of three species of Genus *Calicnemia* Strand

Morphological characters	<i>C. pulverulans</i> Selys	<i>C. imitans</i> Lieftinck	<i>C. sudhaae</i> Mitra
Male			
Labium	White	Brownish - yellow	Blackish brown
Labrum	Blackish brown, broadly bordered with yellow	Dark brownish black	Black
Bases of mandible	Glossy black	Glossy black	Black
Clypeus	Glossy black	Black	Black
Frons	Broad black	Greyish blue	Black
Prothorax	Black, the middle lobe pruinose purplish, the posterior lobe black, elongate, rounded, projecting back over front of thorax.	Black, sides pruinose grayish blue, the posterior lobe trapezoidal, lateral edges rounded, its border straight on middle.	Black, the middle lobe pruinose purplish, the posterior lobe black, rounded, projecting back over front of thorax.
Thorax	Black, appearing blue from pruinescence except dorsum, which is black, and encloses narrow antehumeral pruinose blue stripes, laterally the whole of the side bluish due to pruinescence, except postero-lateral suture; black beneath.	Velvet-black, but appearing grayish-blue from pruinescence; a pair of narrow, straight antehumeral pruinose stripes; laterally the whole of the sides bluish due to pruinescence, except an indefinite stripe over the second suture.	Black, the antehumeral stripe pruinose blue, laterally the posterolateral suture black; otherwise the lateral side is blue due to pruinescence; black beneath.
Legs	Black	Black	Black
Abdomen	Black, thinly pruinose, unmarked; 32-34 mm in length.	Black, basal segments thinly pruinose, intermediate segments with steely blue reflections; 29-30.5 mm in length.	Black, thinly pruinose, unmarked; 28-30 mm in length.

Morphological characters	<i>C. pulverulans</i> Selys	<i>C. imitans</i> Lieftinck	<i>C. sudhaae</i> Mitra
Wings	Hyaline; pterostigma dark reddish-brown, covering a more than one cell, braced; three cells between the discoidal cell and nervure descending from the subnode. 17-18 postnodal nervure in fore-wings, 15 in the hind-wing. Hind-wing 25-27 mm in length.	Hyaline; pterostigma dark reddish-brown, covering about 1½ cell; 15-16 postnodal nervure in fore-wings, 13-14 in the hind-wing. Hind-wing 19.5-22 mm in length.	Hyaline; pterostigma brownish black, covering a more than one cell, braced; three cells between the discoidal cell and nervure descending from the subnode. 16-18 postnodals in fore-wings, 13-17 in the hind-wing. Hind-wing 20-22 mm in length.
Anal appendages	Black, inferiors pale yellow at base and apex; superiors slightly longer than segment 10, inferiors slightly longer than superiors.	Black both, superiors slightly longer than segment 10, inferiors longer than superiors.	Black, inferiors pale yellow at apex, black at base; superiors longer than segment 10, inferiors longer than superiors.
Female			
Labium	White	Light yellow	Yellow
Labrum	Blackish brown, broadly bordered with yellow	Yellow with a black mid-basal point	Brownish yellow
Prothorax	Black with large hook-shaped pale yellow spot on each side of middle lobe; posterior lobe very small, rounded black.	Black above, clear yellow laterally; posterior lobe trapezoidal, lateral edges rounded.	Black, lateral sides yellow; posterior lobe small, rounded black.
Thorax	Black on dorsum, with a narrow antehumeral pale yellow stripes on each side of dorsum; laterally pale bluish green or greenish yellow with moderately broad black stripe on the postero-lateral suture; beneath pale yellow.	Black, a pair of narrow, parallel clear yellow antehumeral stripes; laterally the posterior border black on dorsum, the lower remaining yellow and traversed by thick deep black stripe over the second suture. Venter of thorax yellow.	Black on dorsum, narrow olivaceous yellow antehumeral stripes, laterally olivaceous yellow except a black band on the postero-lateral suture; beneath pale yellow.

Morphological characters	<i>C. pulverulans</i> Selys	<i>C. imitans</i> Lieftinck	<i>C. sudhaae</i> Mitra
Legs	Yellow, extensor surface of legs black, spines black.	Yellow, all femora heavily striped with black posteriorly; tibiae and tarsi brown.	Yellow, extensor surface of legs black, spines black.
Abdomen	Deep black except segment 1 which is pale yellow with a small basal dorsal black spot; segment 2 striped with yellow laterally. 31 mm in length.	Segment 1 bright yellow with blackish mid-dorsal spot, 2-5 metallic blue-black with broad yellow lateral stripe. 25-25.5 mm in length.	Black, first segment yellow broadly on sides, yellow lines on the lateral side extends up to the fifth segment; 6 to 10 th segment black on all sides. 28 mm in length.
Wings	Hyaline, pterostigma blackish brown; covering 1½. 16 post-nodal nervures in fore-wing and 15 in hind-wing. Hind-wing 25 mm in length.	Hyaline, pterostigma dark brown. 14-16 postnodal nervures in fore-wing and 13-15 in hind-wing. Hind-wing 20.5-21 mm in length.	Hyaline, pterostigma dark brown, covering more than one cell, 16 postnodal nervures in fore-wing and 15 in the hind-wing. Hind-wing 22 mm in length.

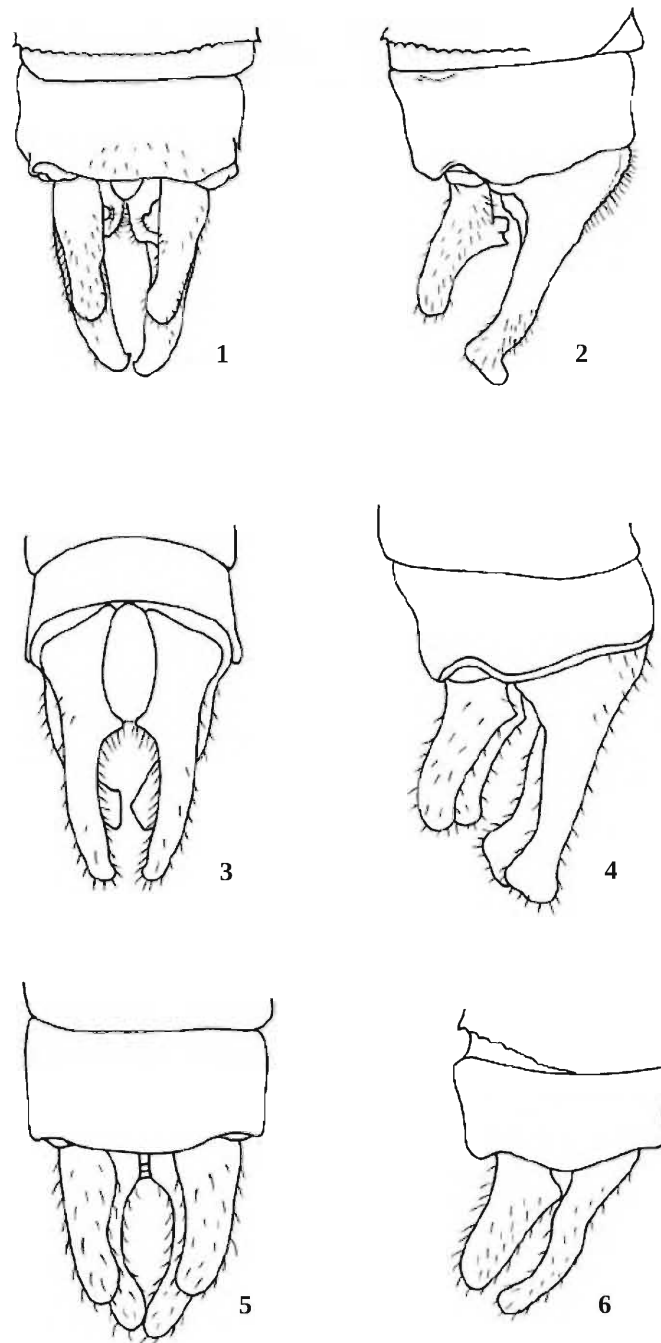
DISCUSSION

Mitra (1994) described *C. sudhaae* and Mitra (2002) provided a detailed description and also compared with specimens of *C. pulverulans* Selys and mentioned the differences, but he did not cite comparison between *C. sudhaae* and *C. imitans* Lieftinck.

C. imitans and *C. sudhaae* are considerably smaller than the *C. pulverulans* and differ further from *C. pulverulans* in having the labrum not bordered with yellow in both sexes. In male, the colour of labium are brownish-yellow in *C. imitans* and blackish-brown in *C. sudhaae*, whereas in *C. pulverulans* it is white in male and female. The female of *C. imitans* and *C. sudhaae* have greater amount of yellow colour on the head and basal abdominal segments when compared to *C. pulverulans*. The anal appendages of these three species are being cited here (Figs. 1-6). These species distinctly differ in their anal appendages, although agrees superficially with other morphological features. From the above, it appears that *C. imitans* and *C. sudhaae* are apparently similar in characters but distinct species as was believed by earlier workers.

SUMMARY

A comparative study of morphological characters of three species of Genus *Calicnemia* Strand i.e. *C. pulverulans*, *C. imitans*, and *C. sudhaae* has been made and found that they are very closely allied, but dissimilarities are there in the length of the hind-wing and abdomen, colour of the



Figs. 1-6. 10th abdominal segment and anal appendages of male: 1. *Calicnemia imitans* Lieftinck (Dorsal view); 2. Lateral view of *C. imitans* (From Lieftinck, 1948); 3. *Calicnemia sudhaae* Mitra (Dorsal view); 4. Lateral view of *C. sudhaae*; 5. *Calicnemia pulverulans* Selys (Dorsal view); 6. Lateral view of *C. pulverulans*.

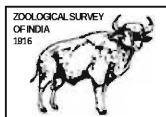
labium and labrum, differences in their anal appendages and conclusion was made that these three species are distinct ones.

ACKNOWLEDGEMENTS

Authors wish to express their deep-felt gratitude to Dr. Ramakrishna, Director, Zoological Survey of India for providing facilities and Dr. Animesh Bal, Scientist-E and Head, Entomology Division-B, ZSI, Kolkata for his suggestions and encouragement. Thanks also due to Dr. M. Prasad, Retd. Scientist- C of the same department for critically going through the manuscript.

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Rec. zool. Surv. India : **109**(Part-3) : 85-89, 2009

A NEW SPECIES OF THE GENUS *CAMPTOMYIA* KIEFFER (DIPTERA : CECIDOMYIIDAE : PORRICONDYLINAE) FROM MAHARASHTRA, INDIA

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INTRODUCTION

While studying the light trap collection of gall midges from Ratnagiri forest in Nanded district of Maharashtra State, India, we encountered a few specimens belonging to genus *Camptomyia*. On closer examination, they turn out to be new to science and described as *Camptomyia ratneshwarae*.

Tribe ASYNAPTINI

Genus *Camptomyia* Kieffer

Camptomyia Kieffer 1894 : 86. Type-species, *erythromma* Kieffer (mon.).

Prodirhiza Kieffer 1913 : 269. Type-species, *Dirhiza multiarticulata* Felt (ori. des.).

Cecidophila Rübsaamen 1916 : 551. Type-species, *artemisiae* Rübsaamen (mon.) = *corticalis* Loew.

Neocamptomyia Mamaev 1961 : 1683, as subg. of *Camptomyia*. Type-species, *Camptomyia abnormis* Mamaev (orig. des.).

Paracamptomyia Mamaev 1961 : 1685, as subg. of *Camptomyia*. Type-species, *Camptomyia salicicola* Mamaev (orig. des.) = *antennata* Felt.

Procamptomyia Mamaev 1961 : 1682, as subg. of *Camptomyia*. Type-species, *Camptomyia spinifera* Mamaev (orig. des.).

Xylocamptomyia Mamaev 1961 : 1689, as subg. of *Camptomyia*. Type-species, *Camptomyia heterobia* Mamaev (orig. des.).

The genus *Camptomyia* is separated from nearest genus *Dirhiza* Loew, by its dorsally recurved genitalia. The genus is represented by 68 species from the world Gagne (2004), of which 8 species are known from India, viz. *artocarpi* Nayar, *hibisci* Felt, *ribiformis* Jaiswal, *ricini* Felt, *sickliformis* Jaiswal, *triangularis* Jaiswal and *webii* Kashyap.

***Camptomyia ratneshwarae* sp. nov.**

(Figs. 1-8)

Male : 0.80 mm long, dark brown. Head : Eyes confluent above, ocelli absent. Trophi : normal. **Palpus** (Fig. 2) quadriarticulate, long, sparsely setose, densely hairy, first segment (9 : 5) short,

subcylindrical, broad apically, $1.80 \times$ as long as thick; second segment (12 : 4), cylindrical, longer than the first, and $3 \times$ as long as thick; third segment (14 : 4), cylindrical, broad apically, $3.5 \times$ as long as thick; fourth segment (17 : 3), longer than the third, broad apically, $5.67 \times$ as long as thick. *Antenna* : 0.77 mm long, nearly as long as the body, with $2 + 14$ segments, segments cylindrical, enlargement constricted medially with long apical stem, each enlargement with one whorl of low circumfila and two whorls of long bristles, enlargement with collar like sensoria distally, segments become shorter terminally; scape (Fig. 6) (7 : 9), cup shaped; pedicel (Fig. 6) (8 : 10), subglobose, nearly as long as scape, wider than long; third segment (Fig. 1) (32), with a long basal prolongation (6 : 5), 0.18 the length of segment $1.2 \times$ as long as thick, enlargement (18 : 7), 0.56 the length of the segment, $2.57 \times$ as long as thick, stem (8 : 4), 0.25 the length of the segment. $2 \times$ as long as thick; fourth segment (Fig. 1) (24), shorter than the third, enlargement (14 : 6), nearly $0.5 \times$ the length of the segment, $2.33 \times$ as long as thick, stem (10 : 4), 0.42 the length of the segment. $2.5 \times$ as long as thick; fifth segment (Fig. 4) (28), enlargement (14 : 9), half the length of the segment. $1.5 \times$ as long as thick, stem (14 : 4), as long as enlargement, $3.5 \times$ as long as thick : sixth to ninth segments similar to the fifth : tenth segment (27), enlargement (12 : 8), nearly half the length of the segment, and $1.5 \times$ as long as thick, stem (15 : 3) longer the enlargement, $5 \times$ as long as thick; eleventh to thirteenth segments (22), shorter than the tenth; penultimate segment (Fig. 8) (11), shorter than the fourteenth, enlargement (9 : 6), 0.82 the length of the segment and $1.5 \times$ as long as thick; apical stem (2 : 1), 0.22 the length of the enlargement and $2 \times$ as long as thick; terminal segment (Fig. 8) (9 : 5), shortest of all, over, 0.82 the length of the penultimate and $1.80 \times$ as long as thick, ending with broad rounded tip. *Thorax* : brown. *Wing* (Fig. 7) (80 : 32), hyaline, $2.50 \times$ as long as broad, with three longitudinal veins, vein R_s parallel to vein R_5 , vein R_5 curved distally reaching costa little beyond the wing apex and interrupting costa at its union, vein Cu forked. *Legs* : long, hairy, metatarsus (14), second tarsal segment (88), longest of all, third tarsal segment (45), shorter than second, fifth (17), shorter than the fourth (25). *Claw* (Fig. 5) (8), simple on all legs evenly curved; empodium (4), half the claw. *Genitalia* (Fig. 3) light brown recurved dorsally, basal clasp segment (40 : 12) nearly oval, setose, $3.33 \times$ as long as broad; terminal clasp segment (15 : 8) short, compact, truncated apically, ending with nail like tooth, inner surface fringed with sharp bristles, 0.38 the length of the basal clasp segment and $2 \times$ as long as broad; dorsal plate (12 : 15) hairy, bilobed, longer and broader than the subdorsal plate, lobes round, broad, broader than long; subdorsal plate (10 : 12) 0.8 the dorsal, bilobed, lobes rounded apically, broader than long; genital rod somewhat spatulate, narrow up to middle becoming broader apically, nearly as long as the basal clasp segment, longer than both the plates, fused with aedeagus; parameres simple, rod like, sclerotized, broad basally, narrow apically, basiforcepes root long, sclerotized, transverse bridge distinct but weakly sclerotized.

Material Examined : *Holotype* : Male, dissected and mounted on slide, labelled, at light, Ratnagiri forest, Nanded dist., Maharashtra, India, 19.viii.2006, Coll. K.A. Ahad. Najam.

Paratype : One male, dissected and mounted on slide, and labelled as in Holotype. The types are deposited at present in the collections of Department of Zoology, Science College Nanded but

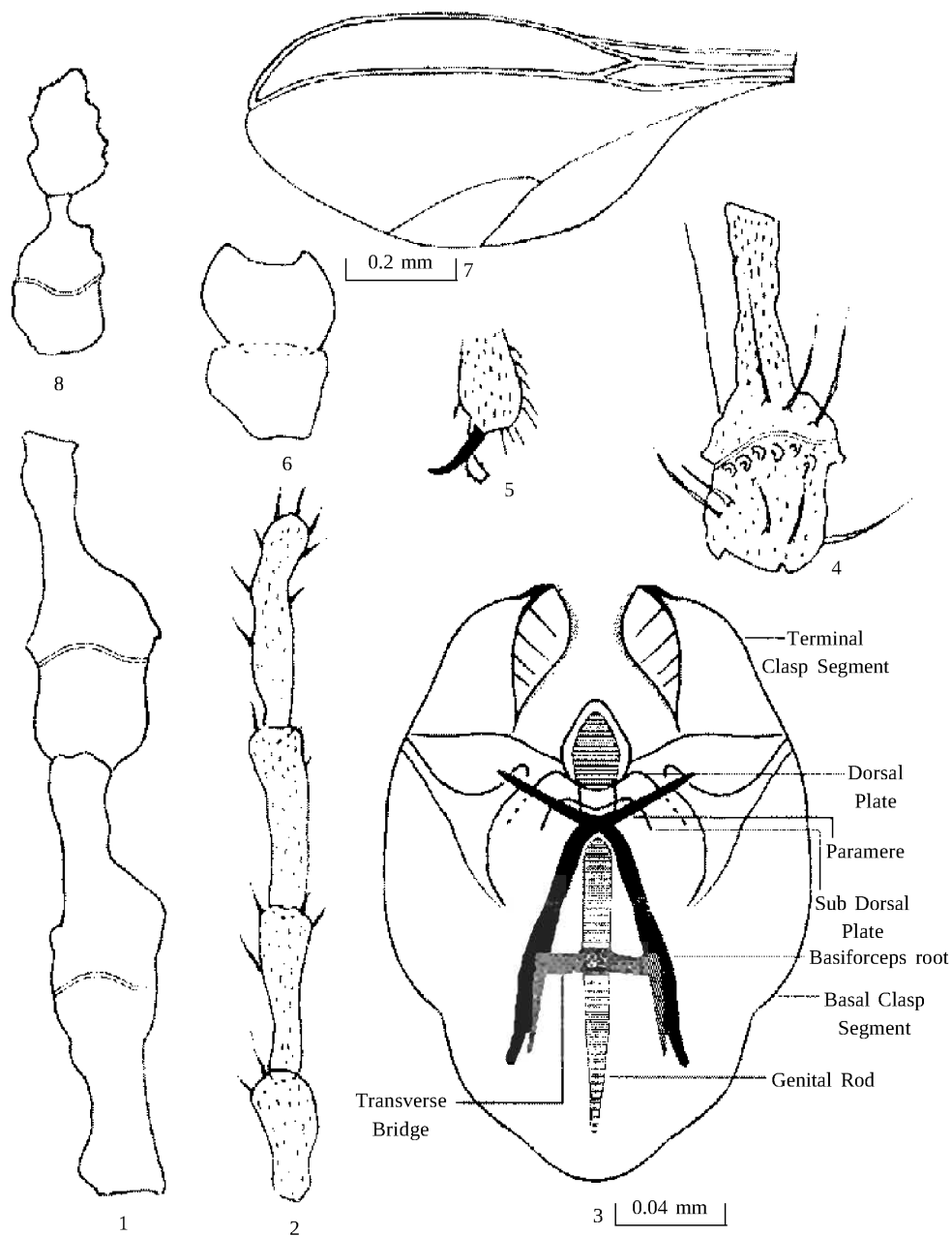
will be deposited in the National Zoological Collections, Zoological Survey of India, Kolkata in due course.

Etymology : The specific epithet *ratneshwarae* refers to Goddess *Ratneshwari* whose temple is located in the vicinity of the type locality.

Remarks : *Camptomyia ratneshwarae* sp. nov. is easily separated from all known Indian species in possessing nearly rectangular and apically truncated terminal clasp segment and antenna with 2 + 14 segments.

Key to Indian species of *Camptomyia* Kieffer

1. Terminal clasp segment nearly rectangular, truncated apically; antennal segments 2 + 14 ... 2
- Terminal clasp segment not as above; antennal segments 2 + 17 or more 3
2. Genital rod some what spatulate apically, parameres simple, rod like *ratneshwarae* sp. nov.
3. Terminal clasp segment short 4
- Terminal clasp segment long 6
4. Terminal clasp segment nearly of same width from base to apex, ending in a short and pointed apex *ribiformis* Jaiswal
- Terminal clasp segment swollen apically or basally 5
5. Terminal clasp segment swollen near distal third, apically with a stout teeth *morindae* Felt
- Terminal clasp segment swollen basally, ending with a chitinished slender teeth *ricini* Felt
6. Terminal clasp segment long and broad 7
- Terminal clasp segment beak like 8
7. Terminal clasp segment swollen in the middle, apically with stout, somewhat recurved chitinised spur apically *hibisci* Felt
- Terminal clasp segment peculiar, apically with two projections, inner one long, finger-like, outer one short elliptical lobe like *sicklififormis* Jaiswal
8. Terminal clasp segment heavily chitinised at the tip *artocarpi* Nayar
- Terminal clasp segment ending with a sharp pointed tooth 9
9. Lobes of dorsal plate rounded apically; claw simple, fourth antennal segment 11 × as long as broad *webii* Kashyap
- Lobes of dorsal plate triangularly rounded apically, claw bifid; fourth palpal segment 6.5 × as long as broad *triangularis* Jaiswal



Camptomyia ratneshwarae sp. nov.

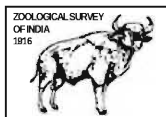
Figs. 1-8. 1. Third and fourth antennal segments, 2. Palpus, 3. Genitalia, 4. Fifth antennal segment, 5. Claw, 6. Scape and pedicel, 7. Wing, 8. Penultimate and terminal segments.

ACKNOWLEDGEMENTS

Our sincere thanks are due to Principal and Head P.G. Department of Zoology NES, Science College, Nanded, for providing necessary laboratory facilities and encouragements. RMS is thankful to the Director, Zoological Survey of India, Kolkata and the Officer-in-Charge Zoological Survey of India, Jabalpur, for facilities.

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Rec. zool. Surv. India : **109**(Part-3) : 91-108, 2009

**DESCRIPTION OF A NEW SPECIES OF *LEPTOBRACHIUM* TSCHUDI,
1838, (AMPHIBIA : ANURA : MEGOPHRYIDAE) FROM
MEGHALAYA, INDIA**

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INTRODUCTION

The genus *Leptobrachium* Tschudi was established in the year 1838 with *hasseltii* as the type species. Subsequently more species were added from South East Asia. Presently there are 21 species in the genus from World (Frost, 2009, online reference). The distribution pattern of the genus shows that it is basically an Indo-Malayan genus. A single species namely *L. smithi* Matsui, Nabitabhata and Panha, 1999 occur in Northeast India (Ohler *et al.*, 2004; Sengupta *et al.*, 2001). Sengupta *et al.*, reported *L. smithi* from Assam claiming it to be a new record for India. They further commented quoting Matsui *et al.*, 1999, that *L. hasseltii* which was reported from North East India by Pillai and Chanda (1979) is actually restricted to Sundas in Thailand and the species of *Leptobrachium* occurring in North East India is *L. smithi*. However, the material of *smithi* deposited in the holdings of E.R.S/Z.S.I by Sengupta agrees with the description of *hasseltii* (Pillai and Chanda 1979). As per Frost (2009) both the species (*L. hasseltii* and *L. smithi*) are occurring in North East India. Further studies would confirm the availability of *L. hasseltii* in North East India.

While surveying the Nokrek Biosphere Reserve in East Garo Hills district of Meghalaya to document its amphibian fauna we collected, among others, twelve frogs of varying sizes that had scarlet eyes. These specimens with bulging eyes, wide mouth, short limbs and its tongue shape were easily differentiated as belonging to the genus *Leptobrachium*. Further studies revealed the identity of the larger specimens as *L. smithi*, and the smaller ones turned out to be new to science. We describe here these specimens as *Leptobrachium nokrekensis* sp. nov. The presence of a lateral line of white glandular tubercles on either side of belly and other meristic differences separate it from the known species *L. smithi* and establishes its identity as new.

ABBREVIATIONS

SVL	Snout to vent length
HW	Head width
HL	Head length
MN	Distance from back of mandible to nostril
MFE	Distance from back of mandible to front of eye
MBE	Distance from back of mandible to back of eye
IFE	Distance between front of eyes
IBE	Distance between back of eyes
IN	Internarial space
EN	Distance from front of eye to nostril
EL	Eye length
SN	Distance from snout to nostril
SL	Distance from front of eye to tip of snout
TYD	Maximum tympanum diameter
TYE	Tympanum eye distance
IUE	Minimum distance between upper eye lids
HAL	Hand length (from base of outer palmar tubercle to tip of third finger)
FLL	Forelimb length
TFL	Length of third finger (from basal border of proximal subarticular tubercle)
FML	Length of femur (from vent to knee)
TBL	Length of tibia
TTA	Tibio-tarsal articulation
FOL	Foot length (from base of inner metatarsal tubercle to tip of fourth toe)
FTL	Length of fourth toe (from basal border of proximal subarticular tubercle)
SS	Distance between shoulder to tip of snout
TAL	Length of tarsus
V/A/ERS/ZSI	Vertebrata/ Amphibia/Eastern Regional Station/Zoological Survey of India

***Leptobrachium nokrekensis* sp. nov.**

Material examined : 1 example, female (HOLOTYPE); Regd.no.V/A/ERS/ZSI/834, Didari Kchibama, Nokrek Biosphere Reserve, East Garo Hills district, Meghalaya (N 25° 29' 0.09", E 90° 18' 55.2", Altitude 1054 m above msl) 11.02.2008, Coll. R. Mathew and party.

2 examples, male (PARATYPE); Regd. no. V/A/ERS/ZSI/835, Didari Kchibama, Nokrek Biosphere Reserve, East Garo Hills district, Meghalaya (N 25° 29' 0.09", E 90° 18' 55.2", Altitude 1054 m above msl) 11.02.2008, Coll. R. Mathew and party.

4 examples, 1 female and 3 males (PARATYPE); Regd. no. V/A/ERS/ZSI/836, Ganol river, Nokrek Biosphere Reserve, East Garo Hills district, Meghalaya (N 25° 30' 19.6", E 90° 18' 20.7", Altitude 964 m above msl) 13.02.2008, Coll. R. Mathew and party.

MATERIALS AND METHODS

The specimens were collected with the help of a hand net and preserved in 5% formaline solution. The measurements were taken with the help of an electronic digital caliper and are in millimeters. For comparison the indices are expressed in thousand.

Description of Holotype : Head broader (HW 11 mm) than long (HL 10 mm; MFE 7.5 mm; MBE 3 mm); tympanum sunk, dark coloured, vertically oval (TYD 1.5 mm, TYE 1 mm), on either side of tympanum a pair of reddish tubercles present; supratympanic fold distinct followed by a red tubercle; upper jaw toothed, with black bands; mouth wide; vomerine teeth absent. Tongue distinctly notched, slightly elongated (Fig. 8A). Eyes bulged (EL 4.5 mm), eye balls on upper part reddish orange, pupil vertical (Figs. 5, 6, 9, 10); Distance between front of eye (IFE 4 mm) half the distance between back of eye (IBE 8 mm), loreal region concave, nostril nearer to tip of snout (SN 1.2 mm; SL 4.2 mm; MN 9.5 mm; IN 2 mm). Dorsum brownish with dark irregular markings all over, powdered with white (Figs. 1, 6). A triangular mark between eyes followed by an inverted 'Y' shaped mark (Fig. 4). A pair of axillary and femoral glands (Fig. 3). Belly creamish, laterally bordered with blackish spots and a line of white glandular tubercles (Fig. 7). Dorsum with tubercles and few longitudinal folds; vent below and above with a pair of reddish warts. A prominent fold of skin overhanging the vent.

Forelimbs slender, moderate, with cross bands; fore-arm longer than hand (FLL 8 mm; HAL 7 mm); fingers free; 1st finger shorter than 2nd; palmar tubercle swollen, prominent; finger tips blunt, slightly swollen (Fig. 12).

Hind limbs moderate with black bands; length of tibia equals the length of foot but shorter than femur (TBL 13.5 mm, FOL 13.5 mm, FML 14 mm); with many tubercles of varied sizes, particularly on femur; TTA reaching posterior corner of eye. Toes webbed at base, inner metatarsal tubercle oval, rather swollen; outer absent (Fig. 8B).

A gravid specimen with light yellowish round eggs visible externally (Fig. 2)

Variations in Paratypes : Almost similar to the holotype except the following :

- 1) Males smaller size
- 2) Lateral glandular line more prominent than in female
- 3) Femoral glands larger in male
- 4) More tubercles near vent in males (Fig. 11).

Measurements of *Leptobrachium nokrekensis* sp. nov. (in millimeters)

Charac- ters	Holotype Female	Paratype Male	Paratype Male	Paratype Female	Paratype Male	Paratype Male	Paratype Male
SVL	35.00	33.00	33.00	34.00	27.00	27.00	26.00
HW	11.00	11.00	11.00	11.00	9.00	10.00	9.00
HL	10.00	11.00	10.50	10.00	9.00	8.50	8.00
MN	9.50	9.00	9.00	8.00	7.00	6.50	7.00
MFE	7.50	7.50	8.00	8.00	6.00	6.00	6.00
MBE	3.00	3.50	3.50	3.50	2.50	2.50	2.00
IFE	4.00	4.00	5.50	4.70	4.00	4.50	4.50
IBE	8.00	9.00	10.00	9.00	8.50	9.00	8.00
IN	2.00	2.30	2.50	3.00	1.00	1.50	2.00
EN	2.00	2.20	2.00	2.50	1.20	1.70	2.00
EL	4.50	4.50	5.50	5.00	4.50	4.50	3.70
SN	1.20	1.70	1.75	2.00	1.20	1.75	1.50
SL	4.20	4.50	5.00	5.00	4.00	3.50	4.00
TYD	1.50	2.00	2.00	2.00	1.70	1.50	1.70
TYE	1.00	1.00	1.00	1.00	0.70	0.70	0.50
IUE	2.50	2.50	3.00	2.50	2.00	3.00	2.50
HAL	7.00	7.00	8.00	7.00	6.00	6.50	6.00
FLL	8.00	8.50	8.50	7.50	6.00	6.00	5.00
TFL	4.00	5.00	5.00	4.00	4.00	3.50	4.00
FML	14.00	14.00	14.00	13.00	11.00	12.00	11.00
TBL	13.50	14.50	14.50	15.00	11.50	12.50	11.00
FOL	13.50	15.00	13.00	14.00	11.50	11.50	11.00
FTL	7.00	8.00	7.00	8.00	6.50	6.00	6.00
SS	13.00	13.00	14.00	15.00	11.50	11.00	11.00
TAL	7.50	9.00	7.00	8.00	6.00	6.00	6.00

The only known species of *Leptobrachium* in India is *L. smithi* Matsui, Nabhitabhata and Panha, 1999 (Ohler. *et al.*, 2004; Sengupta *et al.*, 2001). We collected 5 specimens (measuring 33-59 mm) of *Leptobrachium smithi* from Nokrek Biosphere Reserve between April to June, 2008. The largest specimen was collected in the night from the nursery bed of the forest department in June,

2008. Sensing the approach of the collector it ducked (lowered its head forward) and it allowed sufficient time to be picked up. Another specimen measuring 38 mm collected during the day was picked up from under the stone. This exhibited a contrasting colour pattern of ashy white with dark dorsal and limb markings. However being held in a polythene bag it changed its colour to the dark brown/black customary to *L. smithi* (Figures 13 and 14). We have taken detailed measurements of *L. smithi* to compare with the newly described species.

Leptobrachium smithi Matsui, Nibhitabhata and Panha, 1999

Material examined : 1 ex. Regd.no. V/A/ERS/ZSI/860, Rengsangre, Nokrek Biosphere Reserve, West Garo Hills district, Meghalaya (N 25° 34' 21.2" E 90° 17' 57.8"; Altitude 522 m above msl), 19.06.2008, Coll. R. Mathew and party.

1 ex., Regd. no. V/A/ERS/ZSI/861, Daribokgre, Nokrek Biosphere Reserve, East Garo Hills district, Meghalaya (N 25° 29' 34.8" E 90° 19' 26.9" ; Altitude 1119 m above msl) 24.06.2008, Coll. R. Mathew and party.

3 exs. Regd. no. V/A/ERS/ZSI/862, Daribokgre, Nokrek Biosphere Reserve, East Garo Hills district, Meghalaya (N 25° 28' 33.5" E 90° 19' 57"; Altitude 1119 m above msl) 30.04.2008, Coll. R. Mathew and party.

Diagnostic characters : Larger species , dorsum smooth with large dark markings; flanks with distinct dark spots; belly light coloured, mottled with brown.

Measurements and indices of ***Leptobrachium smithi***

Charac- ters	Measure- ments in mm	Index	Measure- ments in mm	Index	Measure- ments in mm	index	Index/ Mean
SVL	59.0	59 mm	38.0	38 mm	35.0	35 mm	
HW	25.0	424	16.0	421	15.0	429	425
HL	21.0	356	14.0	368	12.5	357	360
MN	18.0	305	11.5	303	11.5	329	312
MFE	13.0	220	10.0	263	8.5	243	242
MBE	8.0	136	4.0	105	4.5	129	123
IFE	10.0	169	8.0	211	6.0	171	184
IBE	17.0	288	13.0	342	12.0	343	324
IN	5.0	85	4.5	118	3.5	100	101
EN	5.5	93	3.0	79	3.5	100	91
EL	6.5	110	5.5	145	3.5	100	118

Charac- ters	Measure- ments in mm	Index	Measure- ments in mm	Index	Measure- ments in mm	index	Index/ Mean
SN	4.5	76	4.0	105	4.0	114	98
SL	10.0	169	7.5	197	6.0	171	179
TYD	3.0	51	2.0	53	1.5	43	49
TYE	3.0	51	1.5	39	1.5	43	44
IUE	6.0	102	5.0	132	4.0	114	116
HAL	12.5	212	9.0	237	8.5	243	231
FLL	18.0	305	11.5	303	12.0	343	317
TFL	9.5	161	6.0	158	5.0	143	154
FML	24.0	407	16.0	421	15.0	429	419
TBL	21.0	356	14.0	368	13.0	371	365
FOL	18.0	305	13.0	342	11.0	314	320
FTL	12.0	203	7.5	197	7.0	200	200
SS	24.0	407	17.5	461	16.0	457	442
TAL	12.0	203	8.5	224	8.0	229	219

Comparison of indices of *Leptobrachium smithi* and *L. nokrekensis* sp. nov.

Characters	Index/ Mean <i>L. smithi</i>	Index/ Mean <i>L. nokrekensis</i>
HW	425	336
HL	360	312
MN	312	260
MFE	242	228
MBE	123	95
IFE	184	147
IBE	324	289
IN	101	66
EN	91	63
EL	118	151
SN	98	52

Characters	Index/ Mean <i>L. smithi</i>	Index/ Mean <i>L. nokrekensis</i>
SL	179	141
TYD	49	58
TYE	44	27
IUE	116	85
HAL	231	221
FLL	317	229
TFL	154	138
FML	419	415
TBL	365	431
FOL	320	418
FTL	200	226
SS	442	412
TAL	219	230

DISCUSSION

Colouration of the eye in the genus *Leptobrachium* is considered as an important taxonomic character and might also play a role in behaviour, especially in intraspecific relationships (Ohler, *et al.*, 2004). The phylogenetic significance of this character was discussed by Matsui *et al.*, 1999. Red, orange or scarlet coloured eyes are seen in *Leptobrachium hasseltii* Tschudi, 1838, *L. hendricksoni* Taylor, 1962, *L. mouhoti* Stuart, Sok and Neang, 2006, *L. pullum* (Smith, 1921) and *L. smithi* Matsui, Nabhitabhata and Panha, 1999. Only *Leptobrachium smithi* has its distribution in India (Ohler, *et al.*, 2004; Sengupta *et al.*, 2001).

The present material numbering 7 examples (2 females and 5 males) do not agree with the description of the known species *L. smithi*. After comparative studies the following observations are drawn to differentiate the two species and establish the identity of *L. nokrekensis* sp. nov.

- i) *Leptobrachium nokrekensis* sp. nov. differs from *L. smithi* in body size and shape : (SVL 26-35 mm in *L. nokrekensis* versus 35-59 mm in *L. smithi*); body is somewhat narrow anteriorly in *L. nokrekensis* and more roundish in *L. smithi*. In *L. nokrekensis*, dorsum is not smooth and is with tubercles and few longitudinal folds. Belly in *L. nokrekensis* is creamish, laterally bordered with black spots and a line of white glandular tubercles; *L. nokrekensis* has a pair of axillary and femoral glands. In *L. smithi* dorsum is smooth with or without discrete dorsal markings, flanks with dark brown roundish and small white spots, belly light coloured.

- ii) *L. nokrekensis* differs from *L. smithi* by having a narrower head (HW index 336); broader in *L. smithi* (HW index 425).
- iii) *L. nokrekensis* has shorter head (HL index 312); longer head in *L. smithi* (HL index 360).
- iv) Distance between mandible to nostrils is less in *L. nokrekensis* (MN index 260); more in *L. smithi* (MN index 312)
- v) Distance between mandible to back of eye is less in *L. nokrekensis* (MBE index 95) and the same is more in *L. smithi* (MBE index 123)
- vi) Distance between front of eyes less in *L. nokrekensis* (IFE index 147); more in *L. smithi* (IFE index 184)
- vii) Distance between back of eye is less in *L. nokrekensis* (IBE index 289) and the same is more in *L. smithi* (IBE index 336)
- viii) Internarial distance is less in *L. nokrekensis* (IN index 66) and the same is more in *L. smithi* (IN index 101)
- ix) Eye to nostril distance is less in *L. nokrekensis* (EN index 63) and the same is more in *L. smithi* (EN index 91)
- x) Eye length is more in *L. nokrekensis* (EL index 151) and the same is less in *L. smithi* (EL index 118)
- xi) Distance between snout to nostril is less in *L. nokrekensis* (SN index 52) and the same is more in *L. smithi* (SN index 98)
- xii) Distance from front of eye to tip of snout is less in *L. nokrekensis* (SL index 141) and the same is more in *L. smithi* (SL index 179)
- xiii) Minimum distance between upper eyelids is less in *L. nokrekensis* (IUE index 85) and the same is more in *L. smithi* (IUE index 116)
- xiv) Forelimb length is less in *L. nokrekensis* (FLL index 229); more in *L. smithi* (FLL index 317)
- xv) Length of tibia is more in *L. nokrekensis* (TBL index 431) and the same is less in *L. smithi* (TBL index 365)
- xvi) Length of foot is more in *L. nokrekensis* (FOL index 418) and the same is less in *L. smithi* (FOL index 320)
- xvii) Length of 4th toe is more in *L. nokrekensis* (FTL index 226) and the same is less in *L. smithi* (FTL index 200)
- xviii) Distance between shoulder to tip of snout is less in *L. nokrekensis* (SS index 412); more in *L. smithi* (SS index 442)

Etymology : The specimen is named after Nokrek Biosphere Reserve from where it was collected.

Habitat : Both Holotype and Paratypes were collected from river/stream inside the reserve forest with less sunshine.

Distribution : Meghalaya.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. Ramakrishna, Director, Zoological Survey of India, Kolkata and to Shri C. Radhakrishnan, Additional Director, Zoological Survey of India, Kozhikode, for facilities and guidance. Thanks are due to Drs. Bryan L. Stuart, Curator of Herpetology, North Carolina Museum of Natural Sciences, USA and Rafe M. Brown, Curator in Charge, Herpetology, KU Biodiversity Institute and Assistant Professor, Department of Ecology and Evolutionary Biology, University of Kansas, USA for valuable information on *Leptobrachium*. We are also indebted to Forest Department, Govt. of Meghalaya for permission and to its Wild Life Division, Tura, Meghalaya for facilities to undertake the work.

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- Figure 1.** *Leptobrachium nokrekensis* sp. nov. (Dorsal view)
- Figure 2.** *Leptobrachium nokrekensis* sp. nov. (Ventral view showing eggs under skin)
- Figure 3.** *Leptobrachium nokrekensis* sp. nov. (Dorsal view of holotype and ventral view of Paratype)
- Figure 4.** *Leptobrachium nokrekensis* sp. nov. (Dorsum showing colour pattern)
- Figure 5 & 6.** *Leptobrachium nokrekensis* sp. nov.
- Figure 7.** *Leptobrachium nokrekensis* sp. nov. (Showing lateral line of glandular tubercles)
- Figure 8A.** *Leptobrachium nokrekensis* sp. nov. (Shape of tongue)
- Figure 8B.** Hindlimbs showing femoral glands & inner metatarsal tubercles in *L. nokrekensis* sp. nov.
- Figure 9.** *Leptobrachium nokrekensis* sp. nov. (Showing eye, pupil & tympanum)
- Figure 10.** *Leptobrachium nokrekensis* sp. nov. (Lateral view)
- Figure 11.** *Leptobrachium nokrekensis* sp. nov. (Showing tubercles near vent)
- Figure 12.** *Leptobrachium nokrekensis* sp. nov. (Showing glandular palmer tubercle)
- Figure 13.** *Leptobrachium smithi* A & B. Dorsal view, C & D. Ventral view
- Figure 14.** *Leptobrachium smithi* A & B. Lateral view, C. Shape of tongue



Figure 1. *Leptobrachium nokrekensis* sp. nov. (Dorsal view)



Figure 2. *Leptobrachium nokrekensis* sp. nov. (Ventral view showing eggs under skin)



Figure 3. *Leptobrachium nokrekensis* sp. nov.
(Dorsal view of holotype and ventral view of Paratype)



Figure 4. *Leptobrachium nokrekensis* sp. nov. (Dorsum showing colour pattern)



Figure 5 & 6. *Leptobrachium nokrekensis* sp. nov.



Figure 7. *Leptobrachium nokrekensis* sp. nov. (Showing lateral line of glandular tubercles)

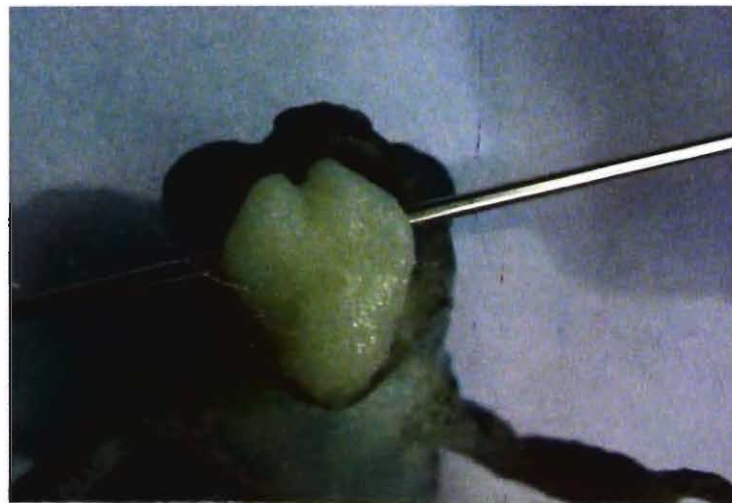


Figure 8A. *Leptobrachium nokrekensis* sp. nov. (Shape of tongue)



Figure 8B. Hindlimbs showing femoral glands & inner metatarsal tubercles in *L. nokrekensis* sp. Nov.



Figure 9. *Leptobrachium nokrekensis* sp. nov. (Showing eye, pupil & tympanum)



Figure 10. *Leptobrachium nokrekensis* sp. nov. (Lateral view)



Figure 11. *Leptobrachium nokrekensis* sp. nov. (Showing tubercles near vent)



Figure 12. *Leptobrachium nokrekensis* sp. nov. (Showing glandular palmer tubercle)



A



B



C

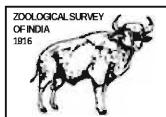


D

Figure 13. *Leptobrachium smithi* A & B. Dorsal view, C & D. Ventral view

**A****B****C**

Figure 14. *Leptobrachium smithi* A & B. Lateral view, C. Shape of tongue



Rec. zool. Surv. India : **109**(Part-3) : 109-114, 2009

DESCRIPTION OF A NEW SPECIES AND NEW RECORD INCLUDING SOME KNOWN SPECIES OF ENCYRTIDAE (HYMENOPTERA : CHALCIDOIDEA) FROM INDIA

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INTRODUCTION

This paper deals with a small collection of Encyrtidae. It deals with records of four known species and description of a new species.

The descriptive method and terminology adopted here follow those of Noyes & Hayat (1984) and Hayat (2006).

The holotype and determined specimens are all deposited in the National collection, Zoological Survey of India, Kolkata.

The following abbreviations are used :

F–Female; M–Male; NRS–Naturhistoriska Riksmuseet, Stockholm, Sweden; QMB–Queensland Museum, Brisbane, Australia; WADA–Western Australian Department of Agriculture, Perth, Australia; ZDAMU–Department of Zoology, Aligarh Muslim University, Aligarh, India; NZC–National Zoological Collection, Zoological Survey of India, Kolkata, India.

Family ENCYRTIDAE

Genus *Adelencyrtus*

1. *Adelencyrtus quadriguttus* (Girault)

1932. *Epitetracnemus quadriguttus* Girault, (3), Holotype F : India (WADA).

1984. *Adelencyrtus quadriguttus* (Girault) : Noyes & Hayat : 224, tax.

Material examined : 1 female (on slide No. EH. 1223, under 3 coverslips), India : Uttar Pradesh, Jaunpur, 18.ii.2005, Coll. S.I. Kazmi & Party (Regd. No. 11385/H3).

Host : Red scale.

Distribution : India : Uttar Pradesh (In original publication locality not given).

Remarks : This species is known as far from and the holotype collected in India (no locality given) and described by Girault (1932). A redescription of the slide-mounted fragmented parts of the type was given by Hayat (1978).

The specimen from Jaunpur (Uttar Pradesh) agrees in nearly all respects with the type except from some minor differences in the relative dimensions of funicle segments, and relative measurements of ovipositor and mid tibia.

Genus *Homalotylus*

2. *Homalotylus albiclavatus* (Agarwal)

1970. *Neoaenasioidea albiclavatus* Agarwal : 27, F. Holotype F : India, Aligarh (ZDAMU).
 1976. *Neoaenasioidea albiscutellaris* Khan : 10, F. Holotype F : India, Aligarh (ZDAMU). Synonymy by Hayat, 1981 : 21, F, tax, Aligarh and Gonda recorded.
 1975. *Homalotylus albiclavatus* (Agarwal) : Hayat, Alam & Agarwal, 1975 : 69, F, M, key, hosts, distribution.
 1984. *Echthroplexis albiclavatus* (Agarwal) : Shafee & Fatma, 1984 : 371, tax, hosts.
 1984. *Echthroplexis albiscutellaris* (Khan) : Shafee & Fatma, 1984 : 373.

Material examined : 1 female, 1 male, India : Uttar Pradesh, Lucknow, NBRI, Botanical Garden, 7.iii.2007, Coll. S. Sheela & Party (Regd. No., 11391/H3 & 11392).

Notes : This is a well known Indian species recorded from several Indian States including Uttar Pradesh (Hayat, 2006).

Hosts : *Pullus* sp. on robusta coffee, *Coffea canephora*; coccinellids predaceous on *Coccidohystric insolita*, same host on *Solanum melongena* and *Achyranthes aspera*; *Nipaecoccus viridis* on *Tephrosia purpurea* and *Zizyphus* sp; *Pseudococcus* sp. on *Citrus medica*; aphid on *Solanum* sp.

Distribution : India : Himachal Pradesh, Jharkhand, Karnataka, Kerala, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal.

3. *Homalotylus flaminus* (Dalman)

1820. *Encyrtus flaminus* Dalman : 390, ?M. Sweden (NRS).
 1876. *Homalotylus flaminus* (Dalman) : Mayr, 1876 : 752.
 1964. *Echthroplexis flaminus* (Dalman) : De Santis : 162.

Material examined : 1 female, India : Uttar Pradesh, Sitapur, 9.iii.2007, (Malaise Trap) Coll. S. Sheela & Part (Regd. No. 11390/H3).

Notes : This is a cosmopolitan species, recorded from the Indian States of Andhra Pradesh, Delhi, Karnataka, Punjab and Uttar Pradesh (Hayat, 2006).

Hosts : Coccinellids predaceous on : *Nipaecoccus* sp. on *Solanum* sp.

Distribution : India : Andhra Pradesh, Delhi, Karnataka, Punjab, Uttar Pradesh.

Elsewhere : South China, Java, Australia.

Genus *Tassonia*4. *Tassonia glorie* Girault

1921. *Tassonia glorie* Girault, 2, F. Holotype F : Australia, Wynnum (QMB).
 1921. *Neblatticida tassoniaeformis* Girault, 3, F. Holotype F : Australia, Queensland, Babinda (QMB).
 Synonymy by Noyes & Hayat : 341.
 1975. *Leiocyrtus aphidivorus* Shafee, Alam & Agarwal : 93-95, F. Holotype F : India, Guntur, Nidubrolu (ZDAMU). Synonymy by Hayat, 2003 : 202.
 1981. *Aphidencyrtus magniclavus* Hayat & Subba Rao : 108. Synonymy with *aphidivorus* by Fatima & Shafee, 1994 : 90. Synonymy by Hayat, 2003 : 202.
 1984. *Tassonia magniclava* (Hayat & Subba Rao) : Noyes & Hayat : 341, tax.
 1994. *Adelencyrtus magniclava* Fatima & Shafee : 69, 71-72, F. Holotype F : India, Aligarh (ZDAMU).
 Synonymy with *aphidivora* by Hayat, 1999 : 398. Synonymy by Hayat, 2003 : 202.
 1994. *Tassonia aphodivora* (Shafee, Alam & Agarwal) : Fatima & Shafee : 90.

Material examined : 1 female (on slide No. EH. 1244) India : Uttar Pradesh, Saharanpur, 14.ii.2005. Coll. S.I. Kazmi & party; 1 female (on slide No., EH. 1245, body damaged) (Regd. No. 11386/H3); Uttar Pradesh, Lucknow, NBRI Botanical Garden, 7.iii.2007, Coll. Sheela & Party (Regd. No., 11387/H3).

Notes : This is a well-known species, and recorded from several Indian States, including Uttar Pradesh (Hayat, 2006).

Hosts : *Hysteroneura setariae* on *Cynodon dactylon*; *Longiunguis sacchari* on *Saccharum officinarum*, same host on *Sorghum* plant.

Distribution : India : Andhra Pradesh, Bihar, Goa, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Punjab, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal.

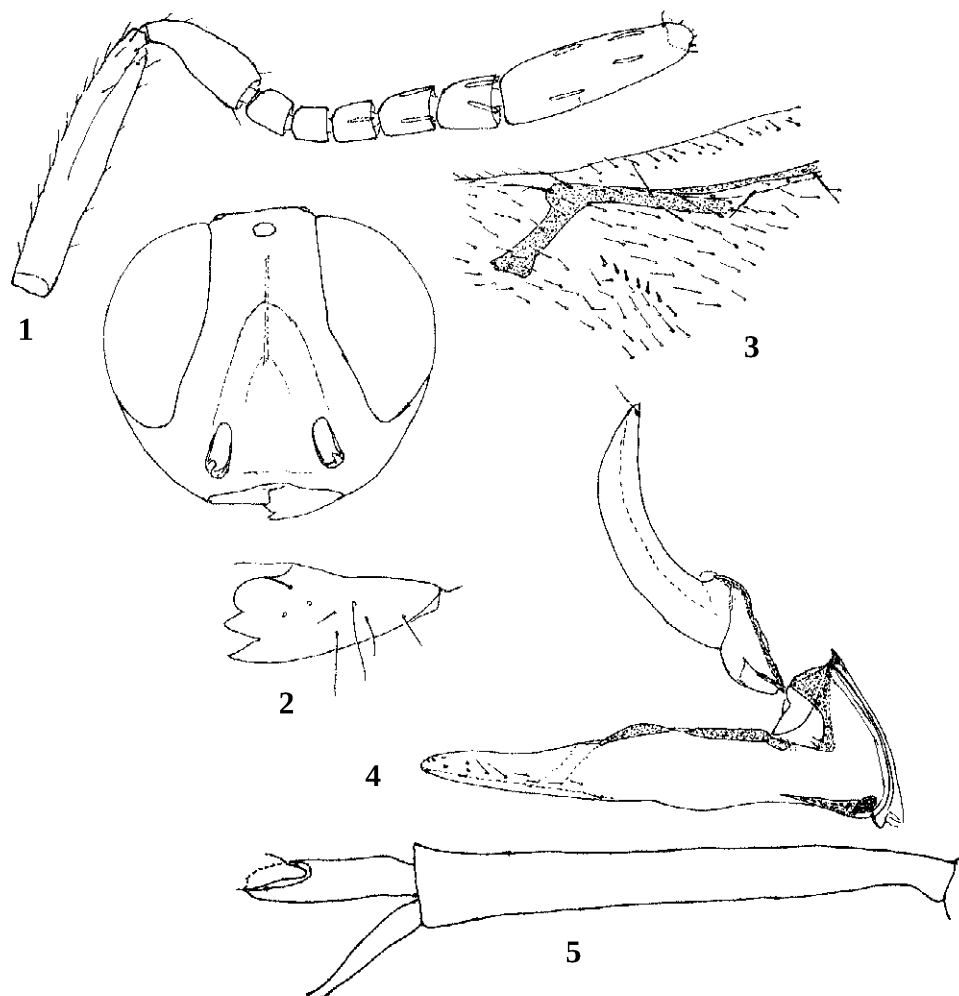
Elsewhere : Australia.

Genus *Trechnites*5. *Trechnites silvestris* sp. nov.

(Fig. 1-5)

Female : Length, 1.36 mm. Body completely dark brown to nearly black, shiny; scutellum intense bluish green with some purple in middle. Antenna with radical, scape except apex, pedicel except apical third to fourth, dark brown; funicle segments 1-3 (F1-3) brown, F4 and F5 pale yellowish brown, clava yellow. Wings hyaline. Legs with coxae, fore and hind femora dark brown; mid femur yellowish brown; diffuse brownish infuscation in basal third of fore tibia, and basal fourth of hind tibia; mid tibia with slight brownish infuscation in basal fourth; rest of leg parts and tarsi pale yellow.

Head (Fig. 2) : Frontoververtex with raised reticulate sculpture, on sides of scrobes with fine, obliquely elongate cells; malar space with slightly raised elongate reticulations. Eyes setose, setae transparent, and each shorter than a facet. Other details as in Fig. 2. Mandible with two teeth and



Figs. 1-5. *Trechnites silvestris* sp. nov., holotype, female : 1. antenna; 2. head frontal, with mandible enlarged; 3. distal veins of fore wing; 4. ovipositor, right half; 5. mid tibia, basitarsus and spur, drawn on same scale as Fig. 4.

a rounded dorsal tooth. Maxillary and labial palpi each 3-segmented as in other species. Antenna as in Fig. 1. Relative measurements. Head frontal width 49; head frontal height 40; frontovertex width, 15.5; mouth fossa width, 20.5; eye length, 31; malar space, 12.5.

Thorax : Mesoscutum with regular reticulate sculpture; scutellum with raised reticulate sculpture, much deeper than on mesoscutum; propodeum with submedian, oblique ridges, and a 'Y' shaped ridge adjacent to each spiracle. Fore wing 2.25x as long as broad; disc proximad of linea clava densely setose, with a small bare area at base; distal venation as in Fig. 3. Hind wing 3.93x as long

as broad; marginal fringe about 0.20x of wing width. Relative measurements. Thorax length, 59; mesoscutum length (width), 27(40); scutellum length (width), 28(28); medial length of propodeum, 3.5; distance between propodeal spiracles, 40.5. Fore wing length (width), 102(45).

Gaster : Relative measurements. Last tergite of gaster length (T VII), 33; ovipositor length, 33.5 (Mid tibia length, 38; mid basitarsus length, 12; mid tibial spur length, 10).

Male : Unknown.

Material examined : Holotype, female (on slide No. EH. 1246, under 4 coverslips) : India : Maharashtra, Jalgaon District, Jamneri Reserve Forest, 14.ix.2007, on *Terminalia tomentosa*, Coll. Bindu & Party. Deposited in NZC (Regd. No. 11388/H3).

Additional specimen : One female (on slide No. EH. 1247, under a coverslip) with same data as the holotype. The specimen lacks antennae and legs and the body is partly damaged (Regd. No., 11385/H3).

Hosts : Unknown. Specimens were captured on *Terminalia tomentosa*, probably psyllids infesting this plant.

Distribution : India : Maharashtra.

Etymology : Latin, *silva* = forest or wood; *silvestris* = belonging to wood or forest.

Remarks : *Trechnites silvestris* sp. nov. is very closely related to *T. aligarhensis* Hayat *et al.* (1975; see also Kazmi & Hayat, 1995; Hayat, 2006), but differs in having malar space 0.4x of eye length, funicle segments relatively slender, F3 distinctly shorter than F4, funicle segments, except F2, longer than broad; and ovipositor 0.88x of mid tibia. (In *aligarhensis* : malar space 0.34x of eye length; funicle segments relatively robust, F4 and F5 at most only slightly longer than broad; and ovipositor 1.33x as long as mid tibia).

SUMMARY

A new species of the encyrtid genus *Trechnites*, viz. *T. silvestris*, sp. nov., is described and illustrated. Four other known species Encyrtidae are recorded of which *Adelencyrtus quadriguttus* (Girault) is reported after its first description in 1932 from India.

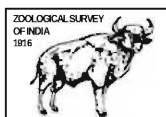
Keywords : Hymenoptera, Encyrtidae, a new species of *Trechnites*, and records of four known species.

ACKNOWLEDGEMENTS

The first author is thankful to the Director, Zoological Survey of India. The second author is grateful to the Indian Council of Agricultural Research, New Delhi, and Dr. V.V. Ramamurthy, (Division of Entomology, Indian Agricultural Research Institute, New Delhi), the National coordinator of the 'Network Project on Insect Biosystematics' for financial assistance. He is also thankful to the authorities of the Aligarh Muslim University and the Chairman, Department of Zoology, A.M.U. for facilities.

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Rec. zool. Surv. India : **109**(Part-3) : 115-116, 2009

Short Communication

FIRST RECORD OF *RHINOCYPHA TRIFASCIATA* SELYS FROM MAHARASHTRA, INDIA (ODONATA : ZYGOPTERA : CHLOROCYPHIDAE)

Among total 18 Indian species/subspecies of Genus *Rhinocypha* Rambur 1842 (Lahiri and Sinha, 1991; Prasad and Varshney, 1995; Mitra, 2002), only one species *i.e.*, *R. bisignata* (Selys) is recorded till date from the Maharashtra State (Prasad, 1996a). While studying the Odonata collection from Maharashtra State we came across the some specimens of *Rhinocypha trifasciata* Selys. Previously, *R. trifasciata* Selys has been reported from Punjab (Kailana-Fraser, 1927; Laidlaw, 1917); Himachal Pradesh (Kangra valley-Fraser, 1934; Solan-Lahiri and Sinha, 1991); Jammu (Lahiri and Sinha, 1991); Uttar Pradesh (Kumar, 1982; Lahiri and Sinha, 1991), Western Himalaya (Asahina, 1955; Kumar and Prasad, 1981), Uttarakhand (Dehra Dun, Mussorie-Bhasin, 1953; Garhwal Hills-Prasad, 1974); Chattisgarh (Bastar-Prasad, 1996b); Nagaland and West Bengal (Mitra, 2002). Distribution of this species has not been reported earlier from Maharashtra. This present communication is intended to report the extended distribution of *R. trifasciata* Selys in the Maharashtra.

Material examined : 2GG, 1E, Burgaon, Nagpur, 26.03.2004, Coll. S.B. Mondal (ZSI Registration No. 4749/H13, 4750/H13, 4751/H13).

Measurements : G : abdomen 24 mm in length; hind-wing 26 mm in length; E : abdomen 22 mm in length; hind-wing 30 mm in length.

Diagnostic characters : *Male* : Head glossy black in front, velvety black above; labium and labrum unmarked. Thorax black marked on sides with a broad broken yellow band; mesothoracic triangle very large, pale blue, extending from alar sinus to anterior border of thorax. A fine yellow line on first lateral suture, broken above, a shorter line on second lateral suture, incomplete below, a small spot below root of fore-wing. Wings partially hyaline from discoidal cell to apex, grayish by transmitted light, palely yellow at base, vitreous area bluish- violaceous or emerald green, according to the angle which it is viewed. Three blackish-brown bands traverse the hind wings from costa to posterior border. An apical band extending inwards to outer end of pterostigma, the iridescent area limited anteriorly by R_{ii} ; a medial band is situated at the junction of outer and middle third of the wing with serrated concave inner border, and slightly sinuous convex outer from 4 to 8 cells wide, the iridescent area limited anteriorly by R_{ii} . An inner band with its inner border in line with distal to level of the node, limited costal wards by R_{4+5} , reaching the hind border of the wing, moderately straight on its proximal, but with only one prolongation on its distal border. Abdomen black, marked on each side of segments 1 to 3 with a small apico-lateral yellow spot.

Female : Head similar to male with a medial spot on hind border of occiput and moderately sized bright yellow spot on cheek near the eye. Thorax yellow in its upper half, this colour continued narrowly along both sides of the triangle. The mesothoracic triangle dark ochreous. Wings evenly and palely enfumed throughout, with a pale greenish tint. Abdomen black, marked with ochreous as follows: A large lateral spot on segment 1, an apical spot and a basal stripe on segments 2 to 4, segment 5 with a small basal spot and segments 2 and 3 have a vestigial ventral stripe.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. Ramakrishna, Director, Zoological Survey of India and Dr. Animesh Bal, Scientist-E, Head, Division of Entomology- B, ZSI, Kolkata for providing various facilities and their kind encouragement.

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